THIRTY-NINTH ANNUAL REPORT

OF

LOCAL GOVERNMENT BOARD,

1909—10.

SUPPLEMENT TO THE REPORT

OF THE

BOARD'S MEDICAL OFFICER

CONTAINING A

REPORT BY THE MEDICAL OFFICER

ON

INFANT AND CHILD MORTALITY.

Presented to both Houses of Parliament by Command of His Majesty.

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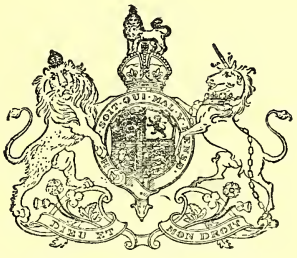

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TO THE RIGHT HONOURABLE JOHN BURNS, M.P., PRESIDENT OF THE LOCAL GOVERNMENT BOARD.

Sir,

To the subject of this report more work has been devoted by the Board and by sanitary authorities throughout the country during the last four years than at any previous period. There has been a widespread awakening to the national importance of child mortality, and a concentration on efforts to diminish it such as has never previously occurred.

In bringing about this result the efforts which culminated in the presidential addresses given by you at the National Conferences on Infant Mortality in 1906 and 1908 have had great weight. Sanitary authorities and their officers having devoted a large proportion of their time and energy to this supremely important matter. The Notification of Births Act* and the appointment of health visitors have had influence beyond the districts in which the Act has been applied and health visitors have been appointed; for the public conscience has been aroused, and education, moral as well as mental, has rapidly progressed.

It is significant that, corresponding with this steadily increasing effort of sanitary authorities, there has been a decline, and an increasing decline, of infant mortality which is unexampled.

Your instructions to me to prepare this report were not, however, to deal with this favourable view of the question. The object of this report has been three-fold: to determine, on the basis of our national statistics, whether reduction of infant mortality implies any untoward influence on the health of survivors to later years; to indicate the communities which are characterised by a continuing high rate of infant mortality; and to assess, so far as is possible, the relative value of the different factors of excessive infant mortality.

In Part I. the relationship of infant mortality to mortality at higher ages is discussed; and it is brought out that the

* This Act, on May 31st, 1910, was in force in 203 areas of local government, viz.: (1) in the City of London and the 28 metropolitan boroughs; (2) in 48 county boroughs; (3) in 46 non-county boroughs; (4) in 63 urban districts; (5) in 17 rural districts.

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continuance of a high infant mortality in a given district, involves the continuance of a centre of national weakness.

In Part II. these centres of national weakness are enumerated. This has necessarily been done in broad outline. In the counties of bad repute there are districts which can compete with the most favourably placed villages in the south of England ; and this being so, there are other districts in these counties whose condition is worse than is set out in Part II.

Another point needs emphasising. There are in districts of London and in provincial towns having low infant death-rates, small special districts and streets in which the infant death-rate is as excessive as in the insanitary colliery villages of Durham and Glamorgan. In these small special districts it is undoubtedly the personal and domestic causes of excessive infant death-rate, which chiefly continue ; but the sanitary authority can do much to counteract and diminish the operation of these causes. The most hopeful line of action consists in the intensive study of the statistics of infant mortality in different parts of his district by each medical officer of health, and the recommendation of administrative action specially directed towards the areas of excessive mortality.

In Part III. an attempt has been made to set out the mutual responsibility of local authorities and of parents in the continuance of excessive infant mortality. The consideration and description of the admirable work now being carried out by many sanitary authorities has been postponed. This is from no lack of appreciation of that work, but in order that a more complete review of it may be given later. Even in the counties having the worst present record, there are districts in which excellent work in the prevention of infant mortality is being done. The considerations set out in Part III. show how great is the need for further work of this kind and for a more universal performance of the elementary duties for which sanitary authorities were appointed.

A summary of the entire report and of my recommendations is given on pp. 34 to 36, and 74 to 78.

I am, Sir,
Your obedient Servant,
Arthur Newsholme.

July 18*th*, 1910.

TABLE OF CONTENTS.

Report by the Medical Officer of the Local Government Board on Mortality during the First Five Years of Life, dealing with the Statistics of Sanitary Areas (grouped) and of Administrative Counties of England and Wales.

Prefatory Remarks.—The object of this report is to secure a bird's-eye view of the incidence of mortality during childhood in the different areas of sanitary administration of the country, and to determine in which of these areas further administrative control over the causes of infant mortality is most urgently needed. Even when its object is thus stated, it has been found necessary to limit the present analysis in the main to the administrative counties and to certain groups of districts within them. The statistics of these counties in a collective form are presented for the first time in this report. Next year it is hoped to analyse more fully the statistics of the chief urban centres of population, especially of those having the highest relative mortality, and at the same time to comment on the methods of administration directly adopted as a means for the prevention of infant mortality, such as the employment of health visitors, babies' clinics, &c., concerning which information is now being collected by the Board.

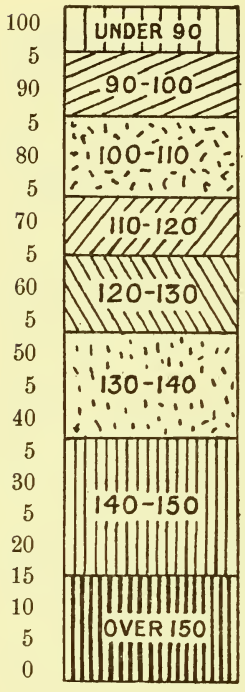
The subject of the present report has already been ably dealt with statistically in the Registrar-General's annual reports, especially in the letter by Dr. Tatham, contained in the report for 1905, and in Dr. Stevenson's contribution to the report for 1908; as well as more widely in works by Drs. McCleary and Newman, and in contributions by Dr. Niven and others which are embodied in the reports of medical officers of health, and in other publications.

From 1905 onwards, medical officers of health were directed in the Memorandum of the Board's Medical Officer as to Annual Reports to prepare an annual statement for their respective districts of the number and the causes of the deaths occurring during each of the four first weeks and during each of the eleven subsequent months of life. Some of these tables in the past have, unfortunately, not been given, or given imperfectly: but it has been practicable—in some instances after supplementary inquiry—to abstract the whole of them for the year 1908, classifying the areas in each registration county into county boroughs and administrative counties; the latter being sub-divided into two groups, consisting of the aggregated rural sanitary areas and urban sanitary areas, not being county boroughs, respectively.

In my annual report to the Board for the year 1908-9 I drew attention to some features of infant mortality in England and Wales during 1908, the point especially emphasised being the unequal distribution of this mortality and the scope for saving

of life indicated by this fact. During 1908 one-fifth of the total deaths at all ages in England and Wales occurred in infants in their first year of life. The exact distribution of this mortality could not then be stated for the entire country, but in the 217 larger provincial towns and the 29 metropolitan boroughs it varied from under 90 to over 150 per 1,000 births as shown in the following diagram:—

Of the total number of children born in 217 *towns and in the* 29 *metropolitan boroughs,*



		Per 1,000.
36,323 or 6·2 per cent.	of the total had an infant mortality	under 90
51,641 „ 9·0	„ „ „ „	90–100
73,067 „ 12·7	„ „ „ „	100–110
50,287 „ 8·8	„ „ „ „	110–120
66,435 „ 11·6	„ „ „ „	120–130
88,811 „ 15·5	„ „ „ „	130–140
116,477 „ 20·3	„ „ „ „	140–150
91,588 „ 15·9	„ „ „ „	over 150

Fig. 1.

I added the following comments:—

The year 1908 was very favourable to a low infant mortality. We are concerned in the present connection, however, chiefly with the differences in mortality, the incidence of which is set out in the preceding diagram. Had the same rate of infantile mortality prevailed among infants in the 21 millions of population comprised in this experience as in the rest of the country, the number of deaths of infants in 1908 in the whole of England and Wales would have been 103,687 or 9,959 fewer than actually occurred. Fifteen per cent. of the infant population in the above towns had an infantile death-rate below 100 per 1,000 births, which is often regarded as a low infantile death-rate for rural districts. The year's weather was favourable to a low mortality; but not markedly more so, if at all, in the towns having a low than in those suffering from a high infant death-rate. The differences between the mortality in these towns and groups of towns leave no doubt that a large proportion of this infant mortality is preventible; and happily, as will be seen in another section of this report, local sanitary authorities are beginning to realise the possibilities of good work in this direction.

Materials are being collected in the Medical Department of the Board for a much fuller review of the conditions affecting mortality during the

first five years of life, and of the possibilities of reducing this loss and of diminishing the incidence of sickness at these ages, which commonly leaves its traces in impaired health in later life.

It is now proposed to consider the infant mortality and the mortality at ages 1-5 of the same year, 1908, in further detail from the standpoint of the preceding paragraph. As many of the sanitary areas are of small size, it is not proposed to state their statistics separately, except under the headings of the county analyses given on pp. 83 to 131, but to group them with other rural or urban districts in the same administrative county, thus obtaining a sufficiently wide basis for useful comment. In the tables in the appendix the rates of mortality for every administrative county are given; but in instituting detailed comparisons, counties having fewer than 2,000 births during 1908 have been disregarded. The same strict limit has not been maintained in dealing with aggregated urban and rural districts, but a reference to the tables in the appendix will show that in most instances this lower limit is greatly exceeded. In dealing with the mortality statistics of a number of aggregates of population for a single year a comparison may be made with other districts during the same year, or with the same or with other districts during preceding years. The latter method would show a lowered death-rate in the majority of instances, and it is clear, in my view, that much progress has been made in the practice of preventive measures, social and medical, and that the improvement experienced has not been entirely due to more favourable climatic conditions. The consideration of these preventive measures in local detail must, however, as already indicated, be postponed. But, the object of the present report being to stimulate more active sanitary and social work, the most helpful plan is to bring into relief the terribly inferior position occupied by a number of administrative counties and by a number of towns in respect to mortality during the first five years of life; and it is from this special standpoint that the whole of the following remarks have been written.

For each of the administrative counties of England and Wales, including the three Ridings of Yorkshire, a statement has been prepared of mortality at the ages 0-1 and 1-5, and of mortality under one year of age from various causes: (*a*) in the entire administrative county, (*b*) in the aggregate urban, (*c*) in the aggregate rural districts. A similar statement is given (*d*) for the aggregate county boroughs in the thirty instances in which there are county boroughs within the county. In each of these groups aggregate death-rates alone are given, but attention is drawn on pp. 83 to 131 to instances of extremely high mortality in individual sanitary districts within each county. The deaths under one year of age are stated per 1,000 births, and the deaths at ages 1-5 are stated per 1,000 survivors at the age of one year.

In the following illustrative table are set out for four administrative counties—two counties at each extreme in respect of infant mortality having been chosen—the information given in tables in the appendix for all the counties and for their divisions:—

1908.—*Infant Mortality at different Ages and from various Causes, and Death-rates at Ages* 1–5 *in England and Wales, and in the Administrative Counties of Durham, Glamorgan, Hereford, and Oxford.*

Death-rate per 1,000 Births.	England & Wales.	Durham.	Glamorgan.	Hereford.	Oxford.
Under 1 week	24·3	33·8	24·8	18·2	20·9
Under 1 month*	40·3	52·1	46·1	31·2	30·6
Under 3 months†	64·4	77·9	76·7	43·4	44 6
3–6 months ...	23·6	30·9	34·5	16·6	13·1
6–12 months ...	32·4	42·2	43·1	15·8	15·3
Entire first year ...	120·4	151·0	154·3	75·8	73·0
Measles	1·9	1·8	3·6	—	—
Whooping cough	5·0	6·6	6·7	2·0	3·7
Diarrhœal diseases ...	19·9	26·9	27·1	5·7	8·1
Premature birth	19·9	23·6	15·5	15·8	17·5
Congenital defects ...	6·7	6·4	5·9	1·6	4·4
Injury at birth	1·0	1·3	·4	·4	·6
Want of breast milk, &c. ...	·8	·2	·3	1·2	—
Atrophy, marasmus, &c. ...	15·0	27·1	24·7	15·4	8·1
Tuberculous diseases ...	4·7	5·8	4·1	2·9	1·6
Convulsions	10·8	13·0	22·0	6·9	7·5
Bronchitis and pneumonia	20·4	25·3	24·7	14·2	10·9
Other causes	14·3	13·0	19·3	9·7	10·6
	120·4	151·0	154·3	75·8	73·0
Number of births ...	942,611	31,291	26,089	2,468	3,204
Deaths at ages 1–5 per 1,000 survivors to the age of 1 year.	61·8	75·4	77·5	43·0	26·3

* *i e.* from birth to 1 month.

† *i.e.* from birth to 3 months.

That the relative positions of administrative counties and of areas within them, as regards infant mortality in 1908, are similar to their positions in other years, can be shown by comparison of the average death-rates for a number of years given by the Registrar-General in his annual reports for registration counties, and in his annual summary for a large number of urban districts. In Figure 2 illustrations of the serial statistics for registration counties are given,‡ the counties having the three highest infantile death-rates and the counties (omitting Montgomery) having the three lowest death-rates in 1908 having been selected.

It will be seen that in the recent years of low infant mortality, the three counties (Glamorgan, Durham, and Lancashire) with a

‡ From p. xlii of the Ann. Rep. of the Reg. Gen. of Births, Deaths, &c. in England and Wales for 1908.

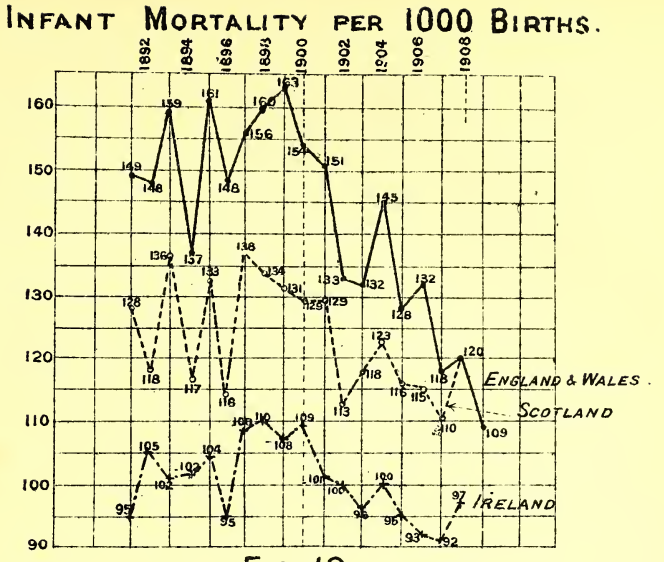


FIG 12.

Annual rates of infant mortality per 1.000 births in England & Wales, Scotland, & Ireland from 1891 to 1909.

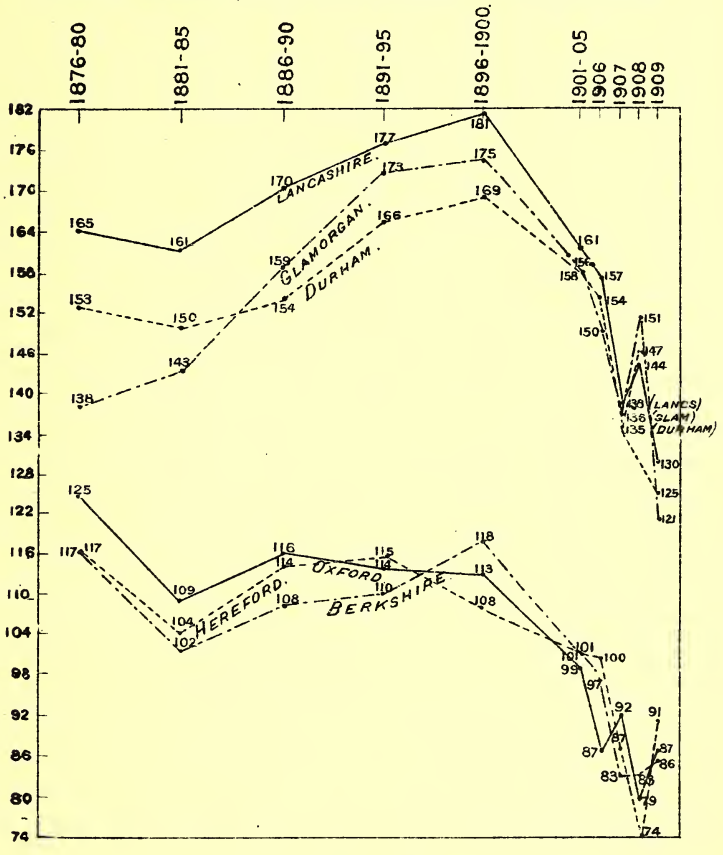


FIG 2.

Infant death-rates in the six Registration Counties having the highest and the lowest infant death-rates in 1908; in quinquennial periods 1876-80 to 1901-05 & single years afterwards.

Weller & Graham Ltd. Litho. Lo

bad record have death-rates approximately as much higher than the death-rates of the counties (Berkshire, Oxford, and Hereford) with a good record, as are the corresponding rates in the years of high infant mortality.

As already stated the year 1908 was a year of low infant mortality, and the rates of mortality discussed in this report must be considered in their relation to each other, rather than with regard to their actual magnitude. The intention being to show where special need exists for an active campaign against avoidable loss of life, the statistics of the year 1908—in so far as they represent the ordinary relative position of the districts dealt with —will serve as well as those of a year of higher infant mortality.

PART I.

INFANT MORTALITY AS RELATED TO MORTALITY AT HIGHER AGES.

It appears desirable first of all to show the relation of infant mortality to mortality at other ages. Tables II. to V. in Appendix III. enable a comparison between death-rates in the first and in the next four years of life, taken in the aggregate, to be made for each administrative county, and for each group of urban and rural districts and county boroughs. The statistics published by the Registrar-General for registration counties enable the comparison for those counties to be pushed to later periods of life, and it has been pursued up to, and including, the fourth lustrum of life in the following pages.*

This comparison is important, because attempts to reduce infant mortality are regarded by many as an interference with natural selection, which must be inimical to the average health of those surviving. According to this school of thought, efforts to save infant life merely prevent the "weeding out" of the unfit, and ensure the survival of an excessive proportion of weaklings.

The statistics in the following pages do not support this view, for, as shown in Table I. in Appendix III., counties having a high infant mortality have also a high death-rate at ages 1-5, and this higher death-rate will be seen shortly to continue at higher ages. The converse rule holds good for the counties having a low infant mortality.

Comparison of Death-rates in Administrative Counties, &c., at Ages 0–1 and 1–5 in 1908.

The infant death-rates in the administrative counties are shown in Table I., page 132; and in Figure 3 the same facts are shewn for counties having more than 2,000 births in 1908

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* The comparison was not pushed further, in view of the possible disturbing effect of migration and of varying industrial conditions.

in comparison with the death-rates at ages 1-5 per 1,000 survivors at the end of the first year of life. In inspecting Figure 3, and it may be added Figures 4-6, it will be borne in mind that measles and whooping-cough prevail to a very varying extent in different years and in different districts during the same year. In this respect they differ materially from diarrhœa, which is always prevalent throughout the country in greater or less degree according to the character of the weather in the third quarter of the year. Measles differs also from diarrhœa in the fact that it is more fatal to children who have passed their first birthday. These points are brought out in the following extract from Table 32 in the Registrar-General's Annual Report for 1908:—

	Deaths under 1 year to 1,000 births.	Deaths per 1,000 survivors.			
		1 year.	2 years.	3 years.	4 years.
Diarrhœal Diseases	19·9	4·7	0·8	0·3	0·1
Measles	1·9	3·9	1·6	1·0	0·6
Whooping-Cough	5·0	3·6	1·3	0·7	0·4

A comparison between one district and another for the same year may, therefore, be vitiated by the greater or less prevalence of measles and whooping cough. When allowance is made for this disturbing influence, the almost uniform coincidence, shown in Table I., page 132, between a high or a low infant death-rate and a corresponding high or low death-rate at ages 1-5, becomes even more significant.

In order to make further comparison easy, the following method has been employed in the following pages and in Figures 3-5:— The infant death-rate of England and Wales in 1908 (120 per 1,000 births) has been taken as a standard and called 100, and all infant death-rates in the counties have been stated in proportion to this.* Similarly the number of deaths at ages 1-5 per 1,000 survivors at age 1 in England and Wales in 1908 (61·8 per 1,000) has been taken as a standard and called 100, and the death-rates in the counties at ages 1-5 have been stated in proportion to this. By this means the proportional rates at 0-1 and at 1-5 are made comparable, and their relative position is at once visible. The comparison, it will be noted, is with England and Wales as a whole, not a severe standard, as it includes the unfavourable districts themselves. The following examples are taken from the lowest and highest on each list of infant mortality:—

* The populations (see Fig. 1) affected by the unfavourable death-rates are so large, that the standard taken, that of England and Wales as a whole, becomes a somewhat low one.

ADMINISTRATIVE COUNTIES.

RELATIVE MORTALITY FIGURES, 1908.

AT AGES 0–1 AND 1–5.

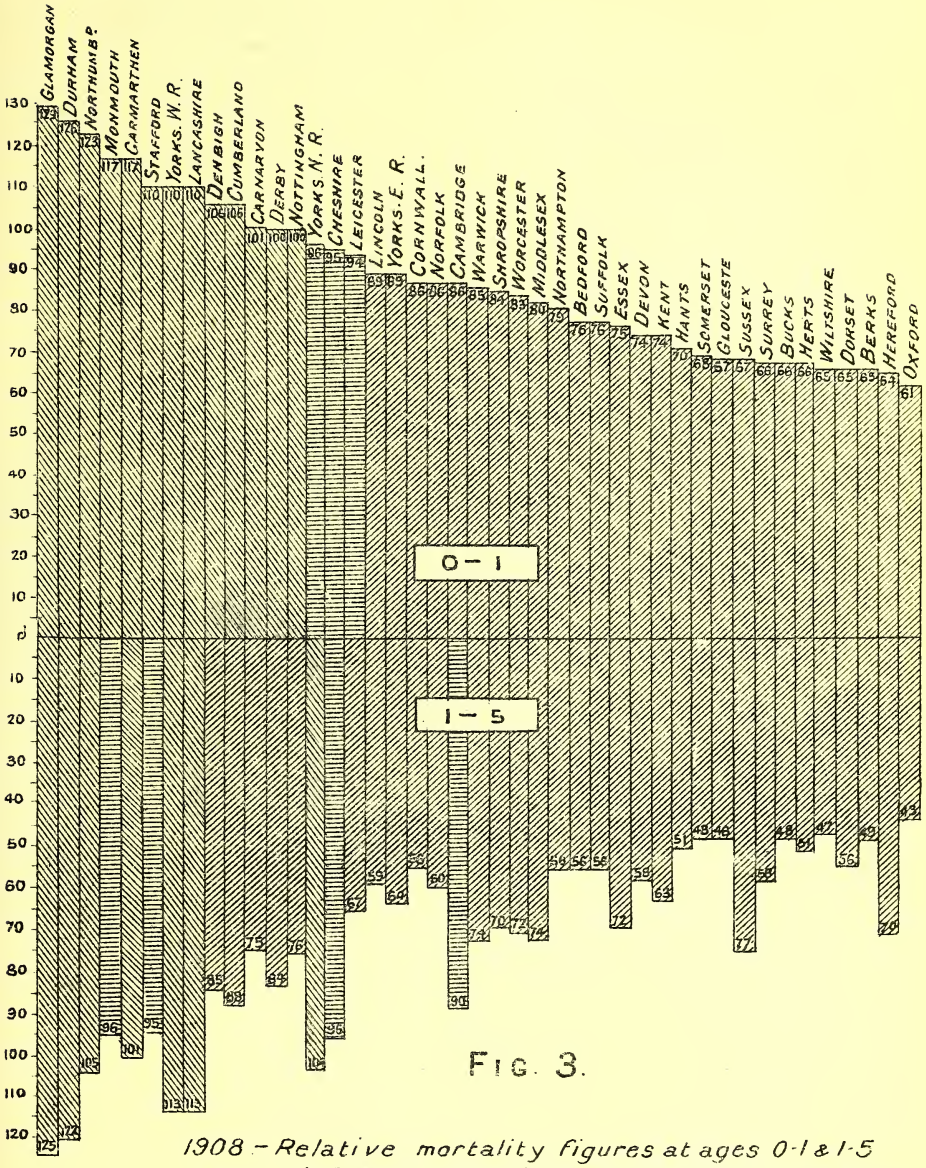

FIG. 3.

1908 – Relative mortality figures at ages 0-1 & 1-5 in the chief Administrative Counties of England & Wales.

4235.

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Aggregate of Rural Districts in Counties

Relative Mortality Figures, 1908

at Ages 0·1 and 1·5

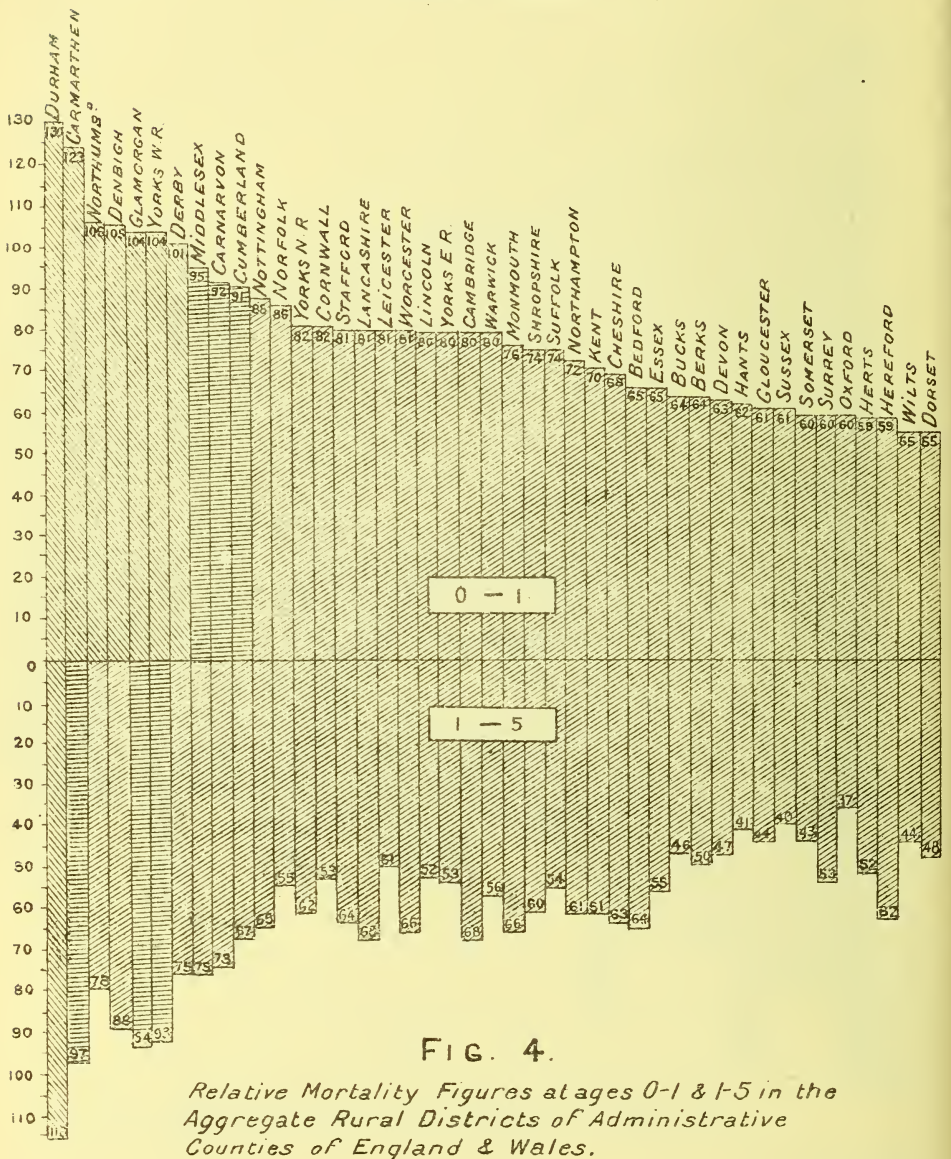

FIG. 4.

Relative Mortality Figures at ages 0-1 & 1-5 in the Aggregate Rural Districts of Administrative Counties of England & Wales.

4258

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Administrative Counties.

	0–1.		1–5.	
Highest	Glamorgan ...	129*	Glamorgan	125*
	Durham ...	126	Durham	122
	Northumberland	123	Northumberland ...	105
	Monmouth, Carmarthen	117	Monmouth	96
			Carmarthen ...	101
	Stafford, Yorks, W.R., Lancashire	110	Stafford	95
			Yorks, W.R., Lancashire ...	113
	England and Wales, 100.		*England and Wales*, 100.	
Lowest	Oxford	61*	Oxford	43*
	Hereford ...	64	Hereford	70
	Berkshire, Dorset ..., Wiltshire	65	Berkshire	49
			Dorset	56
			Wiltshire	47
	Hertford, Buckingham, Surrey ...	66	Hertford	51
			Buckingham ...	48
			Surrey	58

The rule that high or low infant mortalities imply also corresponding high or low death-rates at the age-period 1-5 is clearly brought out by the experience of the administrative counties.

Table I., page 132, and Figure 4 enable the same comparison to be made for the aggregate rural districts in each of the same administrative counties. The same rule emerges for aggregate rural districts as for entire administrative counties, as can be seen in Figure 4, and more particularly in the comparison below between the highest and the lowest in the two series. If it be borne in mind that any relative mortality figure above 90, owing to the low standard taken, implies a somewhat unfavourable death-rate, the correspondence becomes more evident. Figures between 90 and 100 are represented in the diagrams by cross-hatching.

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* These figures should be read as follows :—The infant death-rate of Glamorgan was 29 per cent. and its death-rate at ages 1–5 was 25 per cent. higher than the average for England and Wales, while the infant death-rate of Oxfordshire was 39 per cent. lower, and its death-rate at ages 1–5 was 57 per cent. lower than the average for England and Wales.

The relative mortality figures may be converted into death-rates by a simple rule of three, the infant death-rate in England and Wales (100 above) being 120, and the death-rate 1–5 in England and Wales (100 above) being 61·8 per 1,000 survivors to age 1. The actual rates are given in the tables in Appendix III.

Aggregate Rural Districts in Counties

	0–1.		1–5.	
Highest	Durham... ...	130*	Durham	116*
	Carmarthen ...	123	Carmarthen ...	97
	Northumberland	106	Northumberland ...	78
	Denbigh ...	105	Denbigh	88
	Glamorgan ...	104	Glamorgan	94
	Yorks, W.R. ...	104	Yorks, W.R. ...	93
Lowest	Wiltshire / Dorset ...	55	Wiltshire	44
			Dorset	48
	Hertford / Hereford	59	Hertford	52
			Hereford	62
	Somerset / Oxford ...	60	Somerset	43
			Oxford	37

In the urban districts of the administrative counties the same rule again emerges, as may be seen in Table I. and Figure 5, and from the extreme examples given below. Exceptions are visible, due probably to the unequal prevalence of the special infectious diseases of childhood in different counties during a single year's experience.

Aggregate Urban Districts in Counties.

	0–1.		1–5.	
Highest	Glamorgan ...	138*	Glamorgan	137*
	Northumberland	129	Northumberland ...	117
	Durham / Monmouth	123	Durham	127
			Monmouth	100
	Lancashire / Cumberland	113	Lancashire	120
			Cumberland ...	98
Lowest	Oxford	65	Oxford	54
	Berkshire ...	67	Berkshire	48
	Buckingham / Surrey ...	69	Buckingham ...	50
			Surrey	61
	Hertford ...	70	Hertford	50
	Hereford ...	72	Hereford	84

The aggregate statistics of the county boroughs in each registration county are set out in Tables I. and V. and in Figure 6. In the following list the highest and lowest comparative mortality figures are given:—

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* These are relative mortality figures, not death-rates. They should be read as directed in the footnote on page 11. For the actual rates, see Table I., Appendix III.

Aggregate of Urban Districts excluding County Boroughs in Counties.

Relative Mortality Figures, 1908. At Ages 0–1 and 0–5.

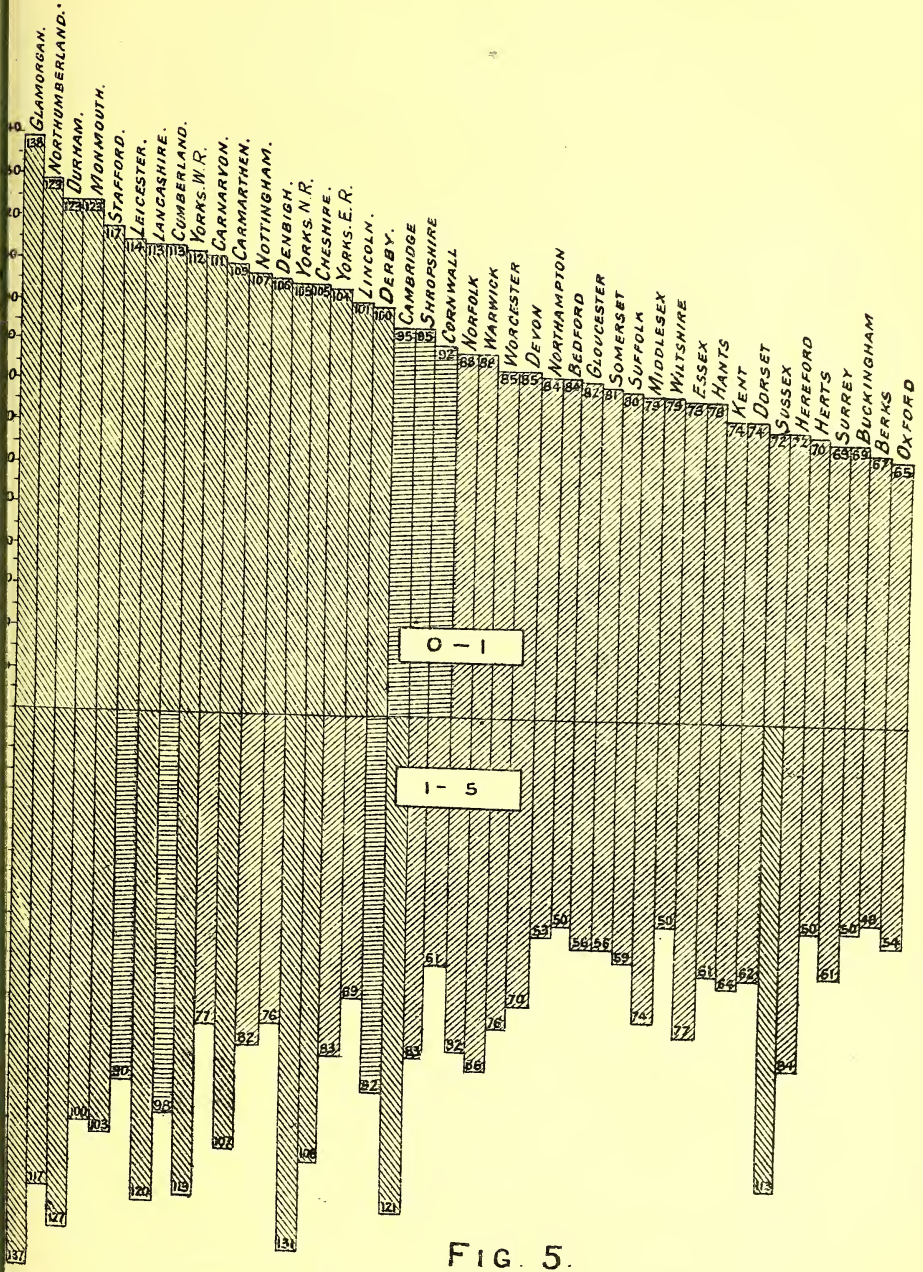

FIG. 5.

1908 :– Relative Mortality Figures at ages 0-1 & 1-5 in the Aggregate Urban Districts of Administrative Counties of England & Wales.

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AGGREGATE OF COUNTY BOROUGHS IN REGISTRATION COUNTIES.

RELATIVE MORTALITY FIGURES 1908.
AT AGES 0-1 AND 1-5.

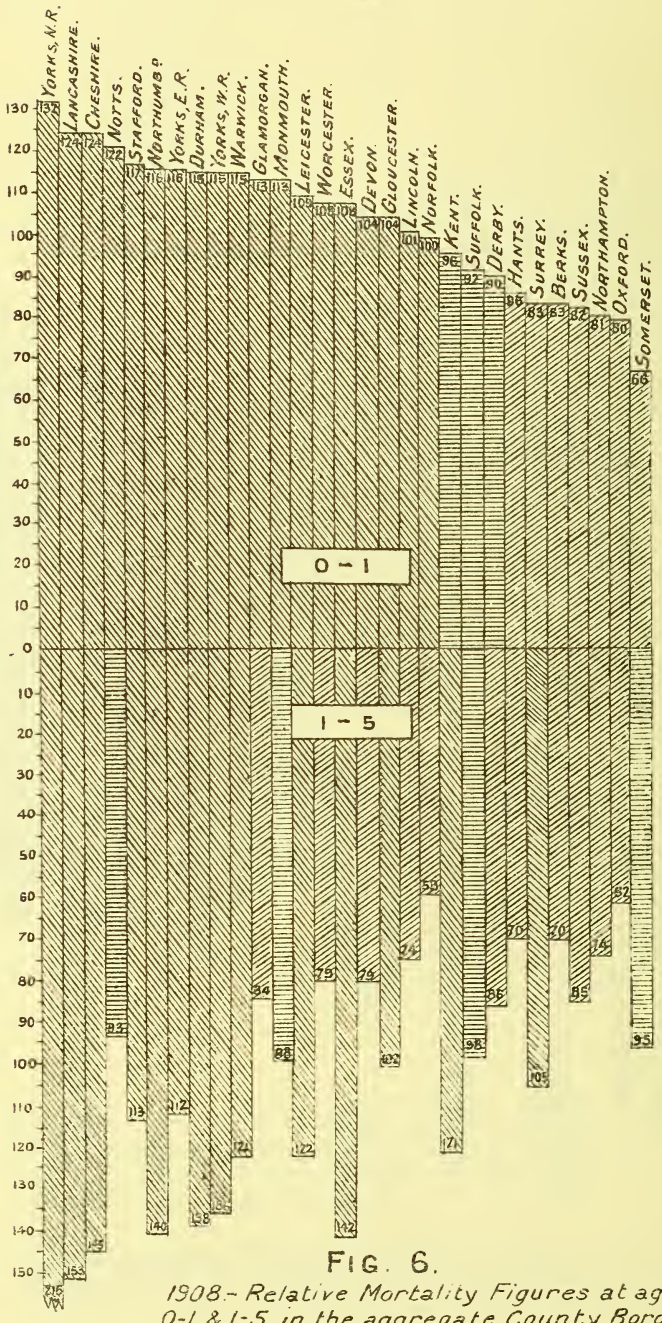

FIG. 6.

1908.- Relative Mortality Figures at ages 0-1 & 1-5 in the aggregate County Boroughs of Registration Counties of England & Wales.

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Aggregate County Boroughs.

	0–1.		1–5.	
Highest	Yorks, N.R. ...	132*	Yorks, N.R. ...	215*
	Cheshire / Lancashire	124	Cheshire ... / Lancashire ...	145 / 153
	Nottingham ...	122	Nottingham ...	93
	Stafford... ...	117	Stafford	113
	Northumberland	116	Northumberland ...	140
	Warwick / Yorks, W.R.	115	Warwick ... / Yorks, W.R. ...	121 / 136
Lowest	Somerset ...	66	Somerset	70
	Oxford	80	Oxford	62
	Northampton ...	81	Northampton ...	74
	Sussex	82	Sussex	85
	Surrey ... / Berkshire	83	Surrey ... ... / Berkshire	105 / 70

The examples given above and the more complete results set out in Figure 6 bring out for county boroughs, as well as for administrative counties and for aggregates of urban and rural districts, the following general conclusion to which the exceptions are not numerous, notwithstanding the disturbing influences mentioned on pp. 9 and 10. *A high infant death-rate in a given community implies in general a high death-rate in the next four years of life, while low death-rates at both age-periods are similarly associated.*

This may be seen more clearly from the following table:—

—	Death-rates at ages		Relative Mortality Figures	
	0–1.	1–5.	0–1.	1–5.
Average of the 8 administrative counties having the highest death-rates.	139·1	69·2	100	100
Average of the 8 administrative counties having the lowest death-rates.	77·9	32·6	56	47

The same point is brought out by calculating the co-efficient of correlation between the death-rates at 0-1 and at 1-5 in 43 counties. This is ·88, the probable error being ·023. There is thus a very high correlation between the amount of infant mortality and of mortality at ages 1-5. (As to co-efficients of correlation, *see* p. 38.)

It is evident that the excess of infant death-rate in the eight first counties over the eight last counties (44 per cent.) is followed by a still larger excess (53 per cent.) of death-rate

* These are relative mortality figures, not death rates. They should be read as directed in the footnote on page 11. For the actual rates see Table I., Appendix III.

during the next four years of life. Any selecting influence of infant mortality is thus more than counterbalanced by the operation of causes of excessive mortality after infancy. These figures, considered alone, render doubtful the existence of any such influence under present conditions.

Comparison of Death-rates in England and Wales for each of the First Five Years of Life from 1855 to 1908.

In the preceding section it has been shown that a general correspondence exists between the magnitude of the death-rate at ages 0-1 and 1-5, as judged by the experience during the year 1908 of the different administrative counties, of their aggregates of urban and rural districts, and of the aggregates of county boroughs within each county. It is important to ascertain whether this holds good for the country as a whole when the statistics of a long series of years are studied.

Dr. Stevenson has kindly supplied me with an unpublished table of the births, and of the deaths in England and Wales during each of the first five years of life, for each calendar year from 1855 onwards. From these data the annual death-rates during each of the first five years of life have been calculated. These are set out in Table X. in Appendix III.* and in Figure 7.

A careful examination of Figure 7 shows that usually when a death-rate in the first year of life is very markedly in excess of or below the death-rates of neighbouring years a corresponding movement occurs in the death-rates for the same calendar year in each of the next four years of life. Exceptions to this rule are visible, the most marked occurring in 1889. It is evident also that the causes producing a heavy infant mortality in any given year operate much more severely at the age of 1-2 than during the next three years of life.

The death-rate† during the first is $3\frac{1}{4}$ times as high as that in the second year, 9 times as high as that in the third year, 14 times as high as that in the fourth year, and 19 times as high as that in the fifth year of life. Hence, Figure 7, in which all the death-rates are given on the same scale, fails to bring out the full force of the coincidence between years of high or low infantile mortality and of high or low mortality during the next four years of life. The relative death-rates (the death-rate in 1908 for each age being stated as 100) are, therefore, also given in Table X., the death-rates being by this means all reduced to the same scale. These when plotted out in a diagram (not reproduced) still fail, however, to bring into view the full force of the existent coincidence between years of high or low mortality in each of the first five years of life. This failure arises from the

---

* For the purpose of this table the rates have been calculated as follows :— The death-rate under one is calculated on the mean number of births occurring in the year under consideration and in the preceding year. The death-rate at ages 1–2 is calculated on the number of survivors at age 1, and so on for each of the next three years of life.

† Calculated on the number of survivors at the beginning of each year of life. See table, page 75, Annual Report of Registrar-General for 1908.

ENGLAND & WALES.

DIAGRAM SHOWING THE ANNUAL INFANT MORTALITY FROM 1855 TO 1908, THE MORTALITY AT AGE 1-2 FROM 1856 TO 1908, AT AGE 2-3 FROM 1857 TO 1908, AT AGE 3-4 FROM 1858 TO 1908, AND AT AGE 4-5 FROM 1859 TO 1908.

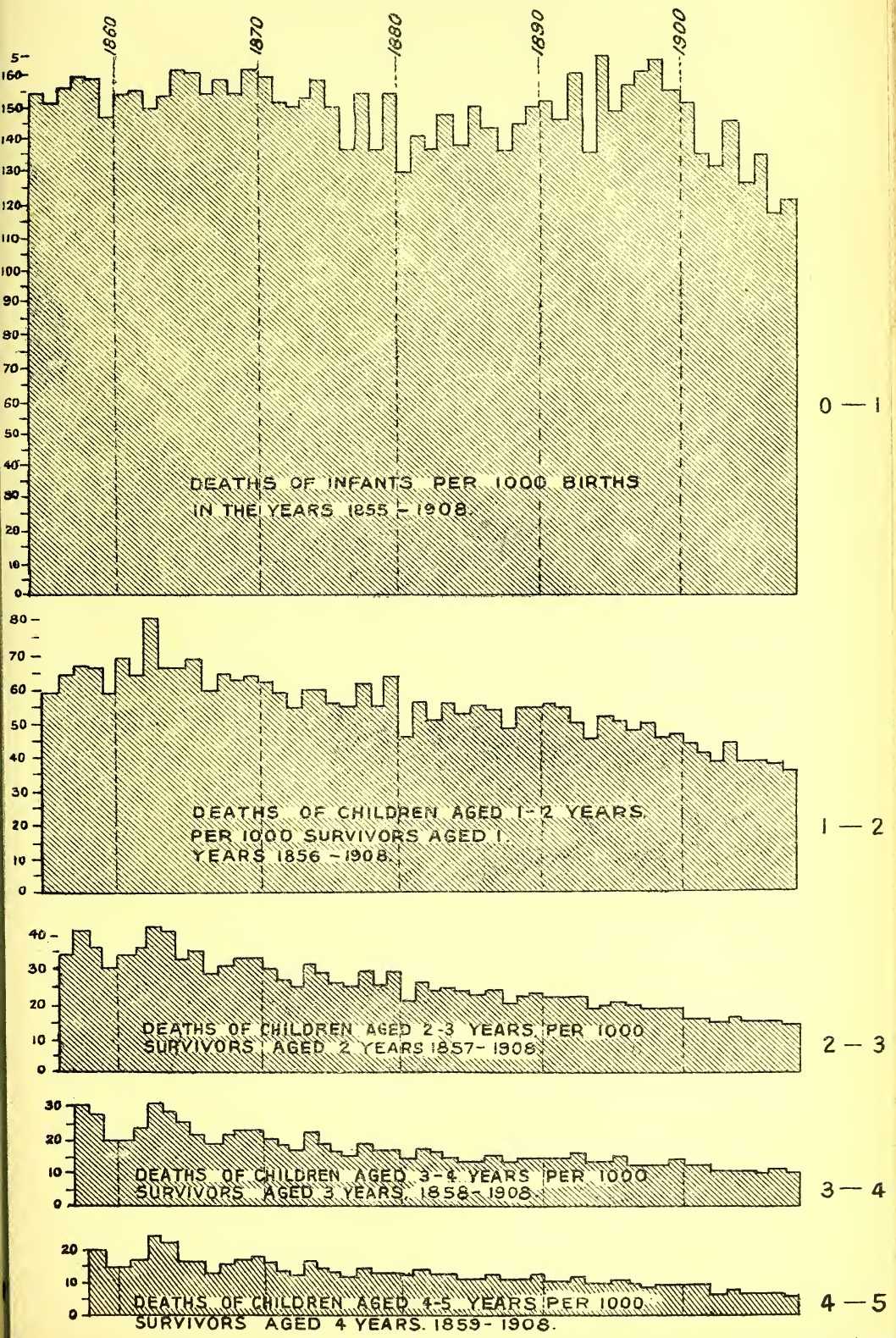

FIG. 7.

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fact that the death-rates at each year of life after the first birthday have steadily declined, while the average infant death-rate has remained stationary until a few years ago. The movement in the direction of steady annual decline at the ages 1-5 overshadows the annual variations. There has been an enormous reduction in the death-rate at each of the ages 1-2, 2-3, 3-4, and 4-5, which until a few years ago has been almost unshared by infants. This is shown more clearly by the following summary of the statistics for

ENGLAND AND WALES.

Infant Death-rates and Death-rates for each of the next Four Years of Life from 1861–65 *to* 1906–08. *Also Relative Mortality Figures for the same periods.*

	Average death-rates at Ages per 1,000 at each age.					Relative mortality figures, the death-rate in 1861–65 being stated as 100.				
	0–1.	1–2.	2–3.	3–4.	4–5.	0–1.	1–2.	2–3.	3–4.	4–5.
1861–65 ...	155	69	37	25	18	100	100	100	100	100
1866–70 ...	157	63	32	22	16	102	92	86	88	90
1871–75 ...	154	59	28	19	14	100	86	77	76	81
1876–80 ...	145	58	27	17	13	94	85	74	68	74
1881–85 ...	139	53	23	15	12	90	78	64	60	69
1886–90 ...	144	53	22	14	10	93	78	61	56	58
1891–95 ...	151	52	21	14	10	98	76	58	56	58
1896–1900 ...	156	49	19	13	9	101	72	53	52	50
1901–05 ...	138	41	16	11	8	90	60	44	44	46
1906–08 ...	124	37	15	9	7	80	53	41	36	40

Taking the two extreme periods in the table (1861-65 and 1906-08) it will be seen that at the age 0-1 the death-rate has fallen 20 per cent., at the age 1-2 it has fallen 47 per cent.; it has fallen 59 per cent. at age 2-3, 64 per cent. at age 3-4, and 60 per cent. at age 4-5.

As will appear afterwards, pre-natal and post-natal causes of disease are operating during the first year of life which have almost ceased to act during the next four years of life. This is only partially true for diarrhœa; but even this disease is much less fatal after the first birthday has been passed (*see* table, p. 10).

Relation between the Death-rates under and over 5 Years of Age.

The investigation of the inter-relation between magnitude of death-rate in infancy and at subsequent ages may be carried further by means of the official statistics of the Registrar-General. In Table 18 on page 19 of his report for 1908, are published death-rates of males from which the following figures have been arranged: —

England and Wales.

Death-rates of Males in Registration Counties (highest ten and lowest ten) at various ages up to 20, in the year 1908.

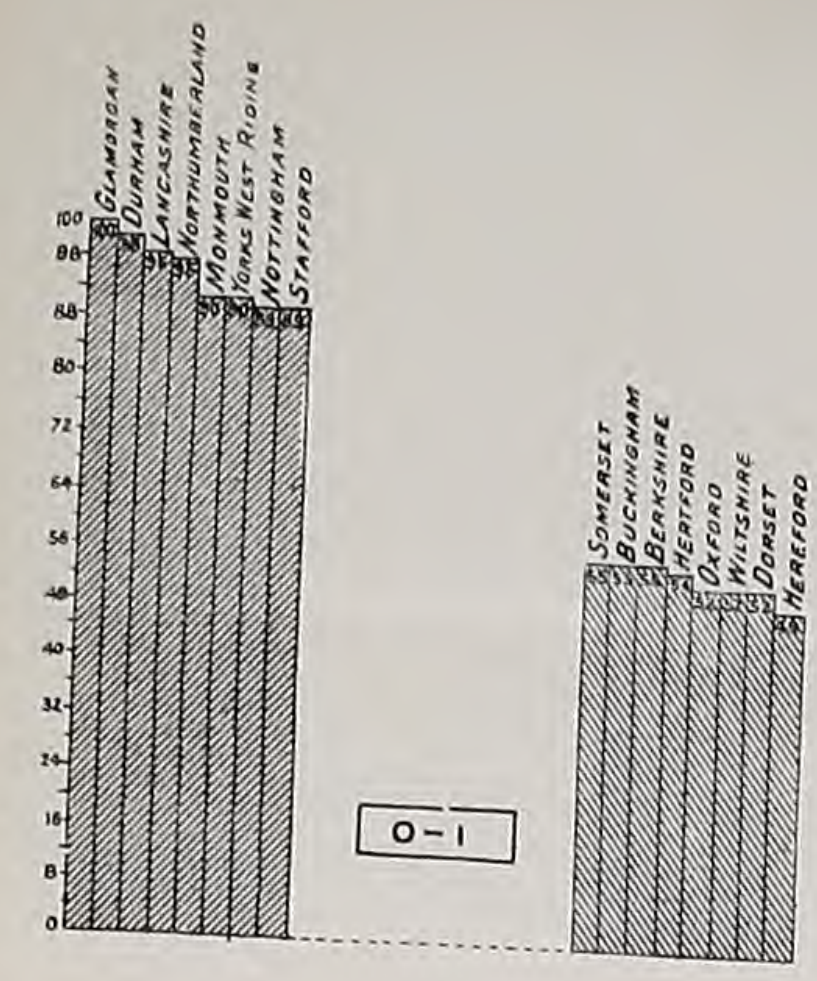
——	Deaths of Children under 1 to 1,000 Births.	Deaths of Males per 1,000 living at ages—			
		0–5.	5–10.	10–15.	15–20.
Counties of—					
Glamorgan ...	151 (*100*)	60·7 (*100*)	3·7 (*100*)	2·5 (*100*)	3·6 (*100*)
Durham	147 (*98*)	60·0 (*99*)	3·6 (*99*)	1·7 (*68*)	3·6 (*100*)
Lancashire ...	144 (*96*)	57·2 (*94*)	4·2 (*114*)	2 2 (*88*)	3·1 (*86*)
Northumberland...	143 (*95*)	55·0 (*91*)	3·7 (*100*)	2·2 (*88*)	3·7 (*103*)
Monmouth ...	136 (*90*)	57·3 (*94*)	3·7 (*100*)	2·4 (*96*)	3·5 (*97*)
Yorks, West Riding	135 (*90*)	51·5 (*85*)	3·4 (*92*)	1·9 (*76*)	2·9 (*81*)
Nottingham ...	134 (*89*)	50·8 (*84*)	3·1 (*84*)	2·0 (*80*)	2·9 (*81*)
Stafford	134 (*89*)	47·3 (*78*)	3·2 (*87*)	1·9 (*76*)	2·3 (*64*)
Somerset	83 (*55*)	26·8 (*44*)	2·4 (*65*)	1·3 (*52*)	2·3 (*64*)
Buckingham ...	83 (*55*)	28·8 (*47*)	2·8 (*76*)	1·5 (*60*)	2·3 (*64*)
Berkshire	83 (*55*)	27·5 (*45*)	2·3 (*62*)	1·5 (*60*)	2·4 (*67*)
Hertford	81 (*54*)	27·3 (*45*)	2·0 (*54*)	1·4 (*56*)	2·3 (*64*)
Oxford	79 (*52*)	26·8 (*44*)	2·4 (*65*)	1·8 (*72*)	2·9 (*81*)
Wiltshire	79 (*52*)	25·8 (*43*)	2·3 (*62*)	1·5 (*60*)	2·6 (*72*)
Dorset	78 (*52*)	24·1 (*40*)	2·0 (*54*)	2·0 (*80*)	3·1 (*86*)
Hereford	74 (*49*)	25·1 (*41*)	2·8 (*76*)	1·0 (*40*)	1·5 (*42*)

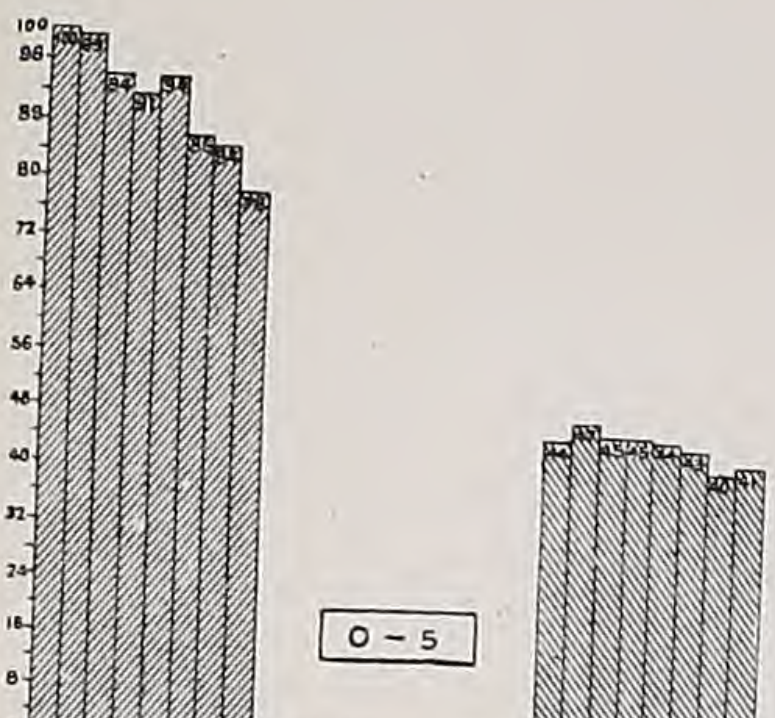
(The figures in brackets give the *relative* mortality figures, that of Glamorgan in each column being stated as 100. These relative mortality figures must not be compared with those given in preceding pages, in which England and Wales is taken as a standard, 100.)

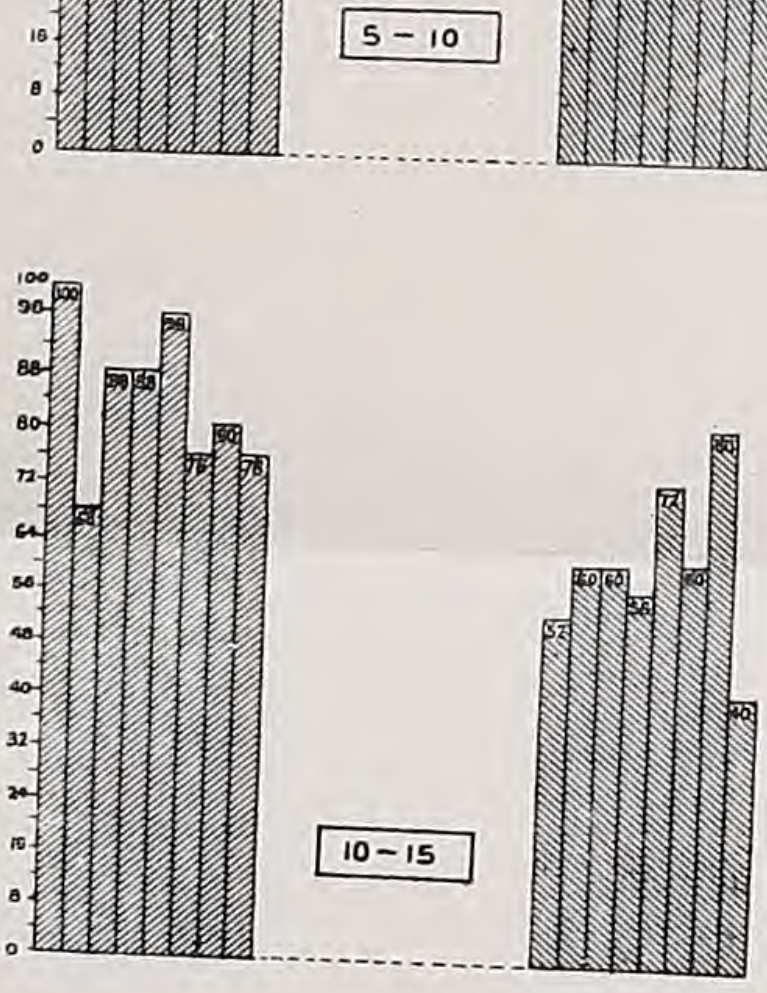
The death-rates in the preceding table can be more easily compared by means of Figure 8, in which are set out for each age the relative mortality figures given in brackets in the table. Unfortunately, the death-rates at ages 1-5 are not given, and 0-5 is taken as the nearest period available for comparison with 0-1. Speaking generally, it will be seen that the eight counties having a high infant mortality also had a relatively high death-rate of males during each of the four first lustra of life; and the eight counties having a low infant mortality had also a relatively low mortality at ages 0-5 and 5-10, and to a diminishing extent at 10-15 and 15-20.

Glamorgan has a death-rate higher than that of any other registration county in England and Wales in infancy and at ages 0-5. Durham is almost as bad at ages 0-5 and 5-10, shows some improvement at ages 10-15, but stands equal with Glamorgan in excessive death-rate at ages 15-20.

Lancashire occupies a position not much better than the two counties already named, and in the period 5-10 occupies a position much worse than them, which calls for further inquiry. Northumberland occupies an unfavourable position, and the worst position of all at the age-period 15-20. Monmouth and the West Riding of Yorks are equal in infancy, Monmouth is







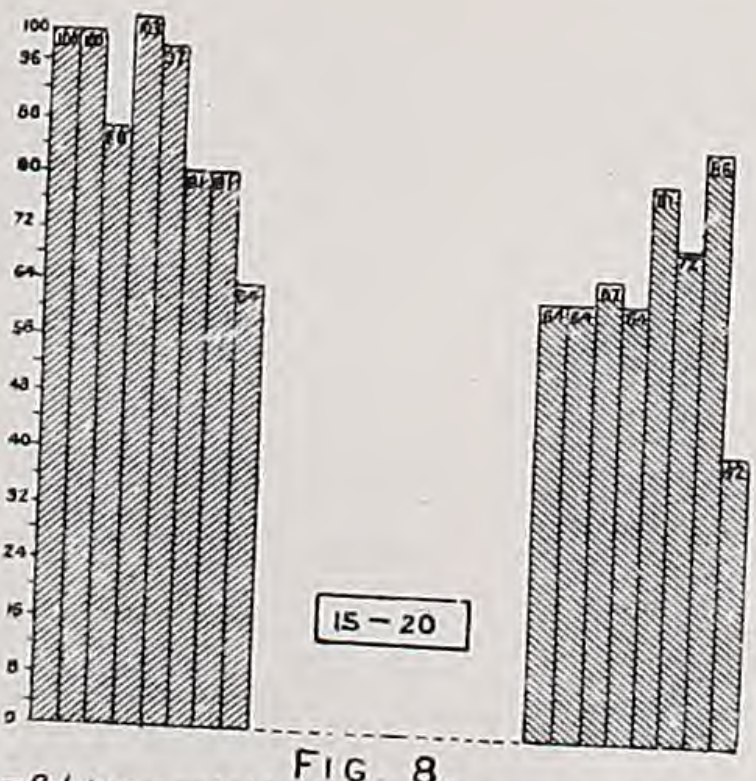


FIG 8.

1908 – Relative mortality figures in the eight Registration Counties having the highest, and in the eight Registration Counties having the lowest infant mortality in 1908. The death-rates at ages 0-1, 0-5, 5-10, 10-15, and 15-20 are each stated in proportion to the corresponding rate for Glamorgan which is taken as 100 for each age-period.

the worse of the two at 0-5 and at 5-10, but the superiority of the West Riding over Monmouth at ages 10-15 and 15-20 is marked. The counties of Nottingham and Stafford are nearly equal at ages 0-5, 5-10, and 10-15, but at 15-20 Nottingham is much inferior to Stafford.

At the other end of the scale Somerset, Buckingham, and Berkshire occupy a highly favourable position at each age-period, with the exception of the age-period 5-10 for Buckingham.

Similar remarks apply to Hertford, Oxford, and Wiltshire, but Oxford at ages 10-15 and 15-20 has higher death-rates than the two counties here grouped with it. Figure 8 shows similar variations in regard to Dorset and Hereford.

The exact degree of correspondence between the death-rates at ages 0-5 and at each of the subsequent quinquennial periods of life can be more exactly stated by means of coefficients of correlation as follows:—

Coefficient of Correlation between—

(1) Male death-rate at ages 0-5 and male death-rate at ages 5-10* ... ... = ·74 ± ·046
(2) Male death-rate at ages 0-5 and male death-rate at ages 10-15* ... ... = ·57 ± ·069
(3) Male death-rate at ages 0-5 and male death-rate at ages 15-20* ... ... = ·43 ± ·083

The correspondence is fairly close between the two earlier quinquennia, diminishing as age advances, but still considerable in each age period. After the age 15, migration doubtless introduces a disturbing influence.

The age-incidence of mortality roughly outlined above will need further investigation on the basis of the forthcoming census figures and of the deaths for several years; but it is clear that *the counties having high infant mortalities continue in general to suffer somewhat excessively throughout the first twenty years of human life, and that counties having low infantile mortalities continue to have relatively low death-rates in the first twenty years of life, though the superiority is not so great at the later as at the earlier ages.*

The data for administrative counties, for their urban and rural divisions, and for county boroughs already given amply confirm this conclusion so far as a comparison between the ages 0-1 and 1-5 is concerned.

There need therefore be no hesitation in making every practicable effort to reduce infant mortality. It is not only in accord with the highest feelings of humanity, but action which secures reduction of infantile mortality also secures reduction of mortality at higher ages.

Natural Selection and Infant Mortality.—No attempt has been made in the preceding pages to settle the moot point as to whether a heavy infant mortality has any selective influence

* Based on the experience during 1908 of the 44 registration counties of England and Wales, excluding London, North and South Wales being taken as two counties.

on the population surviving beyond infancy. The matter cannot be put to the test of actual experiment. To do this it would be necessary to transfer a large sample of the infant population of, say, the county of Durham, who had survived the excessive dangers of the first year of life in that county, to a county like Oxford, transferring an equal number of survivors from Oxford to Durham. The relative experience of two such selected populations might settle the problem. In actual experience, however, the Durham survivors from infancy continue to be exposed to the hurtful conditions prevailing in that county, and the Oxford survivors similarly are favoured by the relatively good conditions of that county. If natural selection during infancy in the county of Durham has left a juvenile population less prone to disease, the effect of this selection is most effectively and completely concealed by the evil environment in that county, which causes the hypothetically stronger survivors to suffer from excessive mortality, so long as they can be traced through life.

It is fair to assume, in accordance with general experience, that the amount of sickness varies approximately with the number of deaths; and there can be no reasonable doubt that in the counties having a high infant death-rate there is—apart from migration—more sickness and a lower standard of health in youth and in adult life than in counties in which the toll of infant mortality is less.

There are few direct observations of the influence of heavy infant mortality on the subsequent standard of health of the infants who have passed through a year of high infant mortality. With the extension of medical inspection of scholars this point will, it is hoped, be more fully investigated. Meanwhile attention may be drawn to the suggestive observations recorded by Dr. Kerr in his annual report to the Education Committee of the London County Council for the year ended 31st March, 1905 (p. 9). These observations tend to show that children born in years of high infant mortality are found, when examined at school in some subsequent year, to have poorer physique than those of an equal age born in years of low infant mortality.

For a special study of the influence of natural selection on the death-rate during the first five years of life, *see* Appendix I., pp. 78 to 83.

PART II.

INCIDENCE OF INFANT MORTALITY IN DIFFERENT PARTS OF ENGLAND AND WALES.

The facts set out in Part I. show the immense national importance of reduction of infant mortality; for an excessive infant mortality is nearly always associated with an excessive death-rate during the next four years of life, and communities showing excessive death-rates in the first five years of life suffer to a greater or less extent from excessive death-rates right up to adult life. Conversely, low infant mortalities are associated in the same communities with low death-rates at subsequent ages up to adult life; and there can be little doubt that, if the influence of migration of population could be eliminated, the effect of conditions influencing health during the early years of life, would be found to persist throughout adult life. Nor are these effects restricted to deaths. All the evidence points to the conclusion that the general standard of health is higher in districts having a low mortality in early life.

These considerations give added importance to the review of the incidence of infant mortality undertaken in Part II. of this report.

A first analysis of infant mortality and of mortality at ages 1-5 throughout England and Wales in 1908 is presented in Table I. (Appendix III.) This is followed in Tables II.-IX. by a more detailed analysis of the mortality during infancy in different weeks and months of life and from some of the chief causes of death. It is proposed to set out in Part II. the relative position of the different counties and of their divisions as regards incidence of infant mortality, distinguishing peculiarities of distribution of this mortality, according to age at death and cause of death. As it has already been shown that death-rates at ages 1-5 closely follow infantile death-rates, it will be unnecessary to consider the former separately in this section. The probable explanations of the differences, or the need for further investigation when explanations cannot be supplied, will be subsequently stated (Part III.). The method here proposed must be followed if a clear view of the elements of the problem is to be secured. Those who are chiefly interested in results may pass at once to Part III.

Infant Mortality at Different Ages.

Durham, Northumberland, and Norfolk occupy the worst position in respect of mortality during the first seven days of extra-uterine life. In the two first of these counties one out of every 30 infants born and, in the last-named county, one out of 32 or 33 born in 1908, died within seven days of birth. At

the more favourable end of the scale are Hereford, Berkshire, Kent, Surrey, and Hertford, with one death in the first week of life out of every 50-55 infants born.

In the aggregate of rural districts in Durham, one of every 27 infants born, in Northumberland one of every 28 infants born, in Cumberland, North Riding of York, and Cambridge one of every 31 infants born in 1908, died within a week of birth; while in the rural districts of Surrey only one of every 61 born and in the rural districts of Bedford one of every 54 born died in the first week.

It is unnecessary to pursue the detailed comparison further, as all the necessary facts are set out in the tables in Appendix III.

The following tabular statement shows the different administrative counties and aggregates of rural districts, urban districts, and county boroughs, respectively, having the highest and lowest death-rates during the first week of life in the year 1908.

Deaths per 1,000 *Births occurring in the* 1*st week of Life.*

—	Administrative Counties.	Aggregate of		
		Rural Districts.	Urban Districts.	County Boroughs
Durham	34	36	32	(26)
Northumberland	33	35	32	33
Norfolk	30	31	(29)	27
Denbigh	29	29	31	—
Cumberland	29	(32)	(28)	—
Carmarthen	29	(27)	(31)	—
Stafford	28	(25)	29	27
Leicester	28	(26)	32	(24)
Yorks, North Riding	28	32	(25)	(24)
Cambridge	(28)	32	(23)	—
Nottingham	(26)	30	(24)	29
Shropshire	(27)	29	(23)	—
Carnarvon	(26)	(21)	32	—
Northampton	(28)	(24)	31	(19)
Cornwall	(28)	(26)	30	—
Yorks, West Riding	(27)	(26)	(28)	27
Yorks, East Riding	(27)	(26)	(29)	27
Worcester	(25)	(24)	(25)	28
Warwick	(21)	(21)	(21)	27
Hereford	18	20	15	—
Kent	18	19	18	15
Berkshire	19	(21)	12	11
Surrey	19	16	(20)	17
Hertford	20	21	20	—
Bedford	(24)	19	(28)	—
Oxford	(21)	(22)	20	16
Suffolk	(26)	(25)	(27)	18

[NOTE.—The rates given in brackets relate to counties or districts whose rates were not within the range of the highest or lowest counties under each heading.]

Similar facts are set out in the following tabular statement, which gives the extremes of the rates for the first month of life shown in Tables II. to V. inclusive. The number of deaths in the first month of life was 1 of 19 born in Northumberland and in Durham, and 1 of 21 born in Stafford; while in Berkshire, Kent and Surrey only 1 of 31 born, and in Hereford and Oxford only 1 of 32 born died in the first four weeks of life.

Deaths per 1,000 *Births occurring in the* 1*st Month of Life.*

—	Administrative Counties.	Aggregate of		
		Rural Districts.	Urban Districts.	County Boroughs.
Northumberland	53	55	52	52
Durham	52	55	50	44
Stafford	47	(44)	48	45
Denbigh	46	46	48	—
Glamorgan	46	(42)	48	(42)
Monmouth	(40)	(32)	(41)	46
Carmarthen	47	48	47	—
Cumberland	45	45	(46)	—
Yorks, North Riding	(44)	48	(41)	(42)
Nottingham	(43)	44	(42)	48
Leicester	(44)	(41)	48	(37)
Yorks, West Riding	(44)	(42)	(44)	45
Worcester	(39)	(41)	(37)	45
Oxford	31	(32)	28	31
Hereford	31	32	31	—
Surrey	32	30	32	32
Kent	32	31	(32)	(39)
Berkshire	32	(32)	32	28
Bedford	(38)	29	(44)	—
Hertford	(33)	32	(34)	—
Buckingham	(37)	(40)	32	—
Lincoln	(40)	(37)	(44)	33
Suffolk	(40)	(39)	(41)	34

(See note under preceding table.)

The extremes of mortality during the whole of the first three months of life are given in the following tabular statement. The number dying during these three months varied from nearly 1 of 12 born in Northumberland and 1 of 13 born in Durham, Glamorgan, Carnarvon, and Carmarthen to 1 of 22 born in Oxford and 1 of 23 born in Hereford.

Deaths per 1,000 *Births occurring in the* 1*st Three Months of Life.*

—	Administrative Counties.	Aggregate of		
		Rural Districts.	Urban Districts	County Boroughs.
Northumberland	79	76	80	77
Durham	78	82	75	(69)
Glamorgan	77	67	80	(69)
Carnarvon	77	73	80	—
Carmarthen	77	79	(75)	—
Stafford	73	(62)	76	77
Denbigh	73	73	73	—
Monmouth	71	(40)	75	79
Yorks, North Riding	(65)	68	(63)	73
Yorks, West Riding	(68)	66	(69)	(70)
Leicester	(66)	(58)	75	(65)
Nottingham	(66)	(63)	(68)	82
Lancashire	(68)	(58)	(70)	72
Warwick	(57)	(57)	(57)	71
Worcester	(57)	(59)	(56)	71
Hereford	43	(46)	40	—
Oxford	45	45	44	52
Berkshire	46	(46)	48	53
Surrey	47	44	48	54
Hertford	48	(45)	(49)	—
Dorset	(49)	44	(52)	—
Wiltshire	(50)	45	(57)	—
Hampshire	(52)	45	(58)	(61)
Buckingham	(51)	(54)	44	—
Somerset	(49)	(47)	(52)	42
Northampton	(59)	(53)	(64)	57

(See note under table on page 20.)

The extremes of mortality during the second trimestrium of life are set out in the following table. During these three months the death varied from 1 of 29 born in Glamorgan, 1 of 32 born in Durham, and 1 of 36 born in Northumberland, Monmouth and Stafford to 1 of 91 born in Gloucester and 1 of 100 born in Dorset.

Deaths per 1,000 *Births occurring at the age of* 3–6 *Months.*

—	Administrative Counties.	Aggregate of		
		Rural Districts.	Urban Districts.	County Boroughs.
Glamorgan	35	27	37	30
Durham	31	32	30	(26)
Northumberland	28	23	30	(25)
Monmouth	28	(18)	30	(20)
Stafford	28	(17)	30	31
Denbigh	27	26	31	—
Lancashire	27	(17)	(28)	30
Yorks, West Riding	26	24	(27)	(26)
Middlesex	(19)	27	(19)	—
Carmarthen	(22)	25	(17)	—
Derby	(23)	23	(24)	(22)
Leicester	(22)	(17)	30	(26)
Cumberland	(25)	(17)	29	—
Yorks, East Riding	(18)	(15)	(23)	31
Yorks, North Riding	(22)	(14)	(26)	37
Cheshire	(24)	(17)	(27)	34
Essex	(15)	(11)	(17)	31
Warwick	(22)	(20)	(23)	28
Dorset	10	4	14	—
Gloucester	11	8	(17)	(24)
Buckingham	12	8	(18)	—
Berkshire	12	(13)	10	(18)
Sussex	13	(10)	15	16
Cambridge	(15)	9	(24)	—
Wiltshire	(13)	10	(17)	—
Suffolk	(14)	(15)	14	16
Hertford	(13)	(12)	14	—
Kent	(16)	(14)	(17)	15
Somerset	(13)	(11)	(17)	9
Northampton	(15)	(15)	(15)	17

(*See* note under table on page 20.)

Dealing with the second half of the first year of life as a whole, the variations of mortality shown in the following table are almost as remarkable as in the second quarter of the first year of life. They extend from 1 of 23 born in Glamorgan and 1 of 24 born in Durham, Monmouth and Carnarvon to 1 of 62 born in Hereford and 1 of 67 born in Oxford and Wilts. The difference would be even greater were the numbers stated in terms of survivors to the end of the sixth month of life.

Deaths per 1,000 *Births occurring at the Age of* 6–12 *Months.*

—	Administrative Counties.	Aggregate of		
		Rural Districts.	Urban Districts.	County Boroughs.
Glamorgan	43	30	48	(35)
Durham	42	41	43	42
Monmouth	41	33	42	(37)
Carmarthen	41	43	38	—
Northumberland	40	(27)	45	(37)
Yorks, West Riding	37	34	38	41
Lancashire	36	(22)	38	45
Derby	33	34	(32)	(24)
Cumberland	(32)	28	(35)	—
Denbigh	(27)	28	(23)	—
Yorks, North Riding	(29)	(16)	37	48
Cheshire	(29)	(16)	(34)	44
Yorks, East Riding	(27)	(24)	(32)	40
Warwick	(23)	(19)	(25)	38
Leicester	(25)	(21)	(31)	39
Wiltshire...	15	11	20	—
Oxford	15	(15)	16	23
Hereford...	16	11	(24)	—
Hampshire	17	(15)	19	23
Surrey	18	(17)	18	(27)
Hertford...	(18)	13	(21)	—
Somerset...	(19)	13	(29)	(28)
Gloucester	(18)	14	(28)	(32)
Bedford	(17)	(17)	16	—
Sussex	(18)	(15)	(22)	24
Northampton	(21)	(18)	(23)	24
Derby	(33)	(34)	(32)	24

(See note under table on page 20)

Infant Mortality from different Causes.

The preceding review deals with the age incidence of infant mortality. In the death registers the age at death of infants is stated with approximate accuracy. Causes to which death is ascribed are stated with much less accuracy, and this is especially true as to deaths during infancy. Hence, some of the statistics given in this section are utilised with hesitation, though they can be employed, if the limitations mentioned as we proceed are borne in mind. For practical purposes most of the statistics of infant mortality given hereafter for different counties are broadly comparable, inasmuch as with certain reservations the same causes of ambiguity are at work throughout the country. Notwithstanding imperfections of diagnosis of disease and of certification of death of infants, there is ample evidence to convict the counties in which infant mortality is excessive, if the evidence as to causes of death is considered in relation to the more accurate evidence as to age at death. For instance, any doubt attaching to the statements that in the counties of

Durham and Northumberland one out of 42 infants born dies as the result of premature birth, while in Kent, Berkshire, and Hereford only about one out of 64 infants born dies from this cause, is diminished by the confirmatory fact that in Durham and Northumberland one out of 30 infants born dies during the first week of life, as compared with one out of 53 born in Kent, Berkshire and Hereford.

The causes of death, set out in Tables VI.-IX., which will be considered in this report, are:—

Premature birth and congenital defects;
Atrophy, debility, and marasmus;
Convulsions;
Diarrhœal diseases;
Measles and whooping-cough;
Bronchitis and pneumonia.

Deaths from Premature Birth and Congenital Defects.

Premature birth and congenital defects overlap considerably as ascribed causes of death, and it is unsafe to consider them separately, although the death-rate from each of them is stated separately for each county and its divisions in Tables VI.-IX. in Appendix III. They cause death chiefly during the first week of life, three out of four deaths certified to be due to premature birth or congenital defects occurring during this week, and nearly nine out of ten occurring during the first month of life. The majority of deaths under these headings are probably ascribable to pre-natal conditions; but a large proportion also to lack of care at and after birth. The variations in deaths under these headings are not inconsiderable.

The administrative counties with the highest rates were:—

Yorks, E. Riding ...	30·3	Northampton	28·0
Durham	30·0	Yorks, W. Riding ...	27·8
Leicester	29·4	Lincoln	27·8
Northumberland ...	29·1	Yorks, N. Riding ...	27·7
Bedford	28·9	Norfolk	27·6

The administrative counties having the lowest death-rates under the present heading were:—

Carmarthen	16·4	Kent	19·5
Hereford	17·4	Monmouth	20·6
Wiltshire	18·6		

Among the aggregate urban districts Bedfordshire stood highest, with a death-rate of 35·6; then came Leicestershire, 32·9; Suffolk, 32·6, and Northampton, 31·9. The lowest were Carmarthen, 12·9; Berkshire, 16·7; Hereford and Oxford, 16·9.

Among the aggregate rural districts, Durham, 31·9; East Riding, 31·5; and Northumberland, 30·5, stood worst; while Monmouth, 16·7; Hereford, 17·7; Kent and Wilts, 18·8, had the lowest rates.

The aggregates of county boroughs showed marked variations, from 42·2 in Northumberland, 38·3 in Warwick, and 36·7 in Monmouth, to 19·7 in Lincoln and 16·3 in Berkshire.

These differences are so great as to call for further investigation. The most obvious suggestion is that the differences are only apparent, and may be accounted for by transference from some other heading. The same explanation has been advanced for the increase in the registered death-rate from premature birth and congenital defects which has occurred in England and Wales, though this explanation is not accepted by others.* The increase under these headings has been from 20·3 per 1,000 births in 1886-90 to 26·1 in 1901-05 and 27·0 in 1906. Since 1906, the death-rate has remained almost stationary (Figure 9).

It is almost certain that a considerable number of infants dying within a few minutes or hours of birth, have in recent years been registered both as births and deaths, and that in former years some of the infants similarly dying were buried as "still-births." Dr. McCleary has given facts tending to show that the registered increase of deaths from premature birth is not entirely explicable by "a transference to the death register of children who would formerly have been buried as still-born."† This source of error has been acting to an unknown extent, and it will not be entirely removed until all still-births occurring at viable ages are made compulsorily notifiable. It is likely that some part at least of the stationary position of the recorded infant death-rate during a long series of years, until a few years ago, is ascribable to this source of error; and that for the same reason the decline in the infant death-rate in the last few years has in reality been somewhat greater than the official figures show.

But, assuming that the registered increase in the death-rate from prematurity and congenital defects cannot thus be completely explained, it is necessary to examine certain other ascribed causes of infant mortality before concluding that there has been until the last few years a real increase of prematurity of birth and consequent mortality, as shown in Figure 9, p. 28.

It is unfortunate that the certification of causes of death in infants is so imperfect. In Glamorgan, for instance, nearly one-half of the total deaths in infancy during 1908 were returned under the indefinite headings mentioned in the next sentence. Reference to Table VI., Appendix III., shows that in 1908 the number of deaths per 1,000 births, ascribed to convulsions, varied from 4·3 in Sussex to 22·0 in Glamorgan; and the number of deaths per 1,000 births ascribed to atrophy, debility, or marasmus varied from 7·2 in Bucks to 27·1 in Durham. These four names all indicate symptoms only, concealing fatal diseases of very different origin. Convulsions may be due to congenital causes, to injury at birth, and to various causes arising after birth, among which probably irritation of the alimentary canal from improper food is the one chiefly operating. The three remaining names, again, may mean, among other things, syphilis, or the results of improper feeding. It is evident, therefore, that under each of these indefinite headings a number of deaths have occurred

* Infant Mortality and Infants' Milk Depôts, by G. F. McCleary, M.D. 1905, p. 22. Infant Mortality, by G. Newman, M.D. 1906, p. 83.

† Loc. cit. p. 22.

due in an undefined proportion to pre-natal and to post-natal conditions.

The following table brings out some points of resemblance and difference between these different causes of death. Each of these causes of death during 1908 was abstracted according to age for two groups of administrative counties, A—including Staffordshire, the West Riding of York, and Lancashire; and B—including Worcester, Middlesex, Essex, and Kent. These groups are fairly representative of communities with high and low infant death-rates respectively.

	Premature Birth and Congenital Defects.		Atrophy, Debility, and Marasmus.		Convulsions.	
	Group A.	Group B.	Group A.	Group B.	Group A.	Group B
Number of births in each group.	112,014	85,886	112,014	85,886	112,014	85,886
Number of deaths in infancy from the conditions enumerated above.	3,093	1,910	2,077	1,125	1,259	473
Number out of 100 total deaths under 1 occurring :— Under 1 week of age.	66·1	64·8	19·3	18·5	18·7	19·2
From birth to 1 month.	88·7	86·9	39·8	40·8	33·7	39·1
1–3 months	7·9	8·8	28·6	27·8	23·0	22·8
3–6 months	2·3	3·1	19·2	19·1	21·8	17·1
6–12 months	1·1	1·2	12·4	12·3	21·5	21·0

As might be expected, nearly nine out of ten of the deaths caused by premature birth and congenital defects occur in the first month after birth, while only about two out of five of the total deaths ascribed to atrophy, debility or marasmus, or to convulsions occur during this period. A further difference appears between convulsions and the deaths from atrophy, etc. Deaths due to convulsions are as large a cause of death in the second six months of infancy as in the second three months, while, at ages 6-12 months, atrophy, &c., is a declining cause of death. These facts suggest the likelihood that two-fifths of the deaths ascribed to atrophy, marasmus and debility and to convulsions—those occurring in the first month of life—may have pre-natal or natal causes nearly to the same extent as the deaths ascribed to premature birth and congenital defects. If this be so, probably a considerable amount of transference between these three headings has occurred.

The statistics for England and Wales as a whole suggest the same conclusion. They are summarised in Figure 9 from a table given on page xliii. of the Registrar-General's Annual Report for 1908.

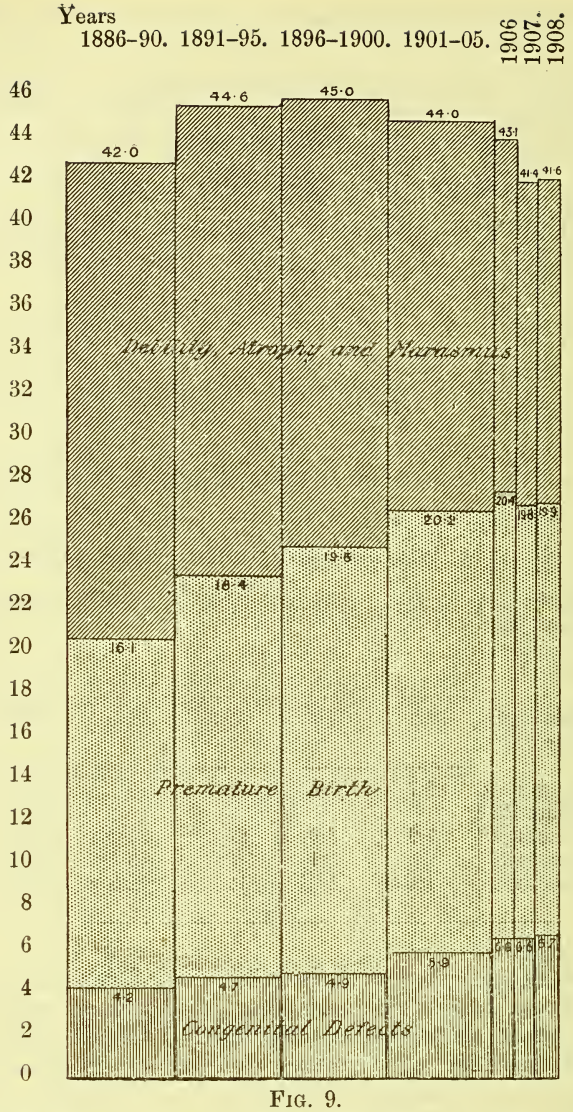


FIG. 9.

England and Wales.—Deaths of Infants under One Year per 1,000 *Births from "Developmental" and "Wasting" Diseases from* 1886 *to* 1908.*

No increase of infant death-rate is shown when premature birth and congenital defects are considered along with debility, atrophy and marasmus; and doubt is thus thrown on the conclusion that in England and Wales the death-rate from premature birth and congenital defects has increased.

An examination of Table VI. in Appendix III. confirms the impression that at the present time, in many of the counties of England and Wales, there is no consistent line of certification of causes of deaths as between "premature birth" on the one

* The actual death-rates from each cause are stated below the top line of each of the two lower columns. The columns are not to be read on the scale from 0 upwards, but from the next horizontal line below the figures. Thus the death-rate in 1886–90 from debility, atrophy, and marasmus was 21·7 per 1,000 births.

hand, and such terms as "atrophy, debility or marasmus" on the other hand.

This is further shown by setting out the counties which have the highest and the lowest registered death-rate under each heading, as is done in Figure 10.

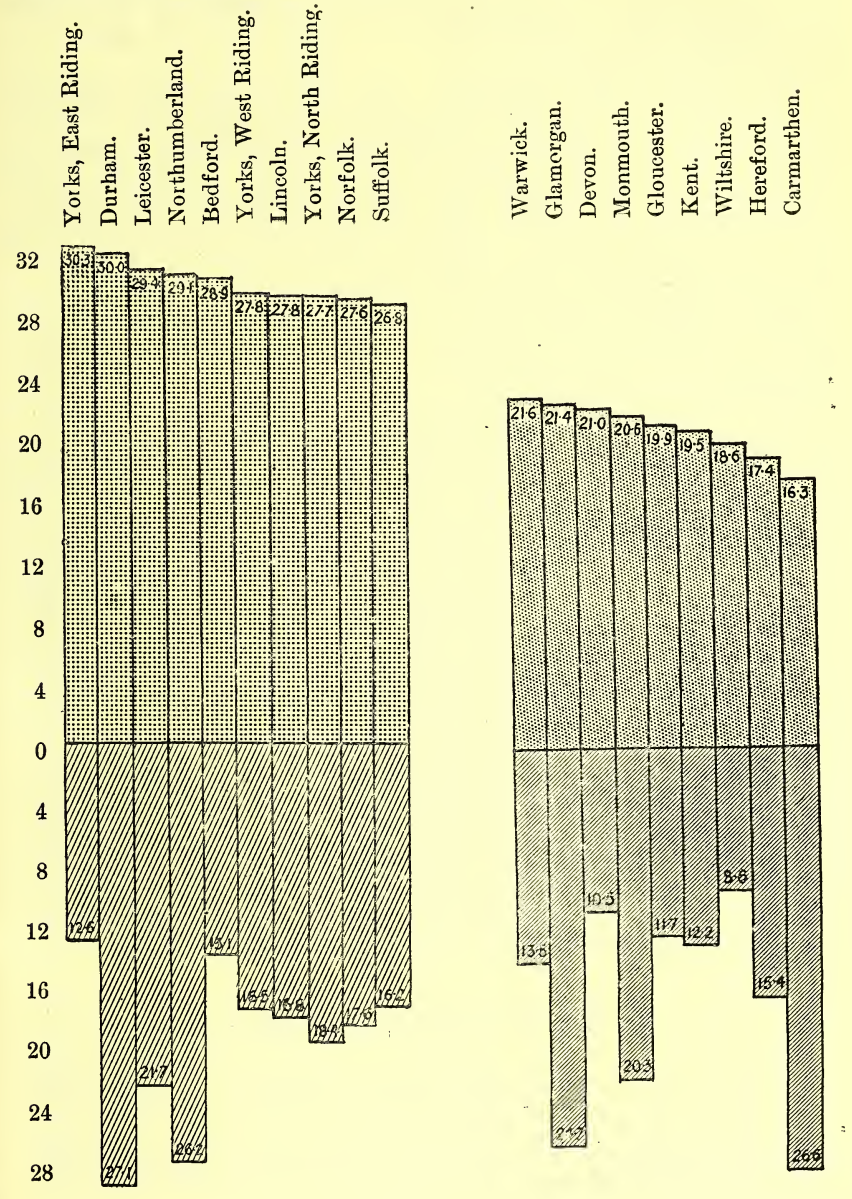


FIG. 10.

Death-rates under One Year per 1,000 *Births in certain Administrative Counties of England and Wales*, 1908, *from Premature Birth and Congenital Defects* (*above the horizontal line*), *and from Atrophy, Debility, and Marasmus* (*below the horizontal line*).

It will be noted that high death-rates from premature birth and congenital defects coincide with almost equally high death-rates from atrophy, debility and marasmus in the counties of Durham, Northumberland and Leicester; while in the East Riding of Yorkshire and in Bedford a high death-rate under the first head is associated with a correspondingly low rate under the second head. At the opposite end of the scale again the same anomalies appear.

In Figure 11 the death-rate from these two groups together during 1908 is shown for each of the chief counties. It will be noted that the death-rate from this double group of developmental and wasting diseases on the whole is lowest in the counties with the lowest total infant death-rate and highest in the counties with the highest total infant death-rate; but the relationship between total death-rate and the death-rate from developmental and wasting diseases is not constant, and certain counties stand out in Table VI., Appendix III., and in Figure 11 as having a higher death-rate from these diseases than their position as regards total infant mortality would lead one to anticipate.

To sum up, the available facts do not appear to justify the conclusion that in England and Wales death from prematurity is on the increase. For it has to be noted that (1) the total infant mortality has not increased, indeed has declined during the last few years (see Figure 7); and that (2) much of the alarm as to increase of mortality from prematurity has been based on the proportion between two variables, viz., the deaths from prematurity and the total infantile deaths, a most fallacious method of stating the facts. It is likely that the transference from still-births mentioned on p. 26 is approaching its maximum in connection with the duty to notify the still-births of infants now thrown on midwives.

There has been some transference between "prematurity" and "marasmus, atrophy and debility" in death-certificates, probably also between these and "convulsions." On the whole, it appears to me that the best plan for most purposes is to consider the two first groups together, as in Figure 11, and in the next section the incidence of deaths from this combined group will be considered.

Developmental and Wasting Diseases.

(Premature Birth, Congenital Defects, Atrophy, Debility, and Marasmus.)

Among administrative counties the twelve highest death-rates were the following:—

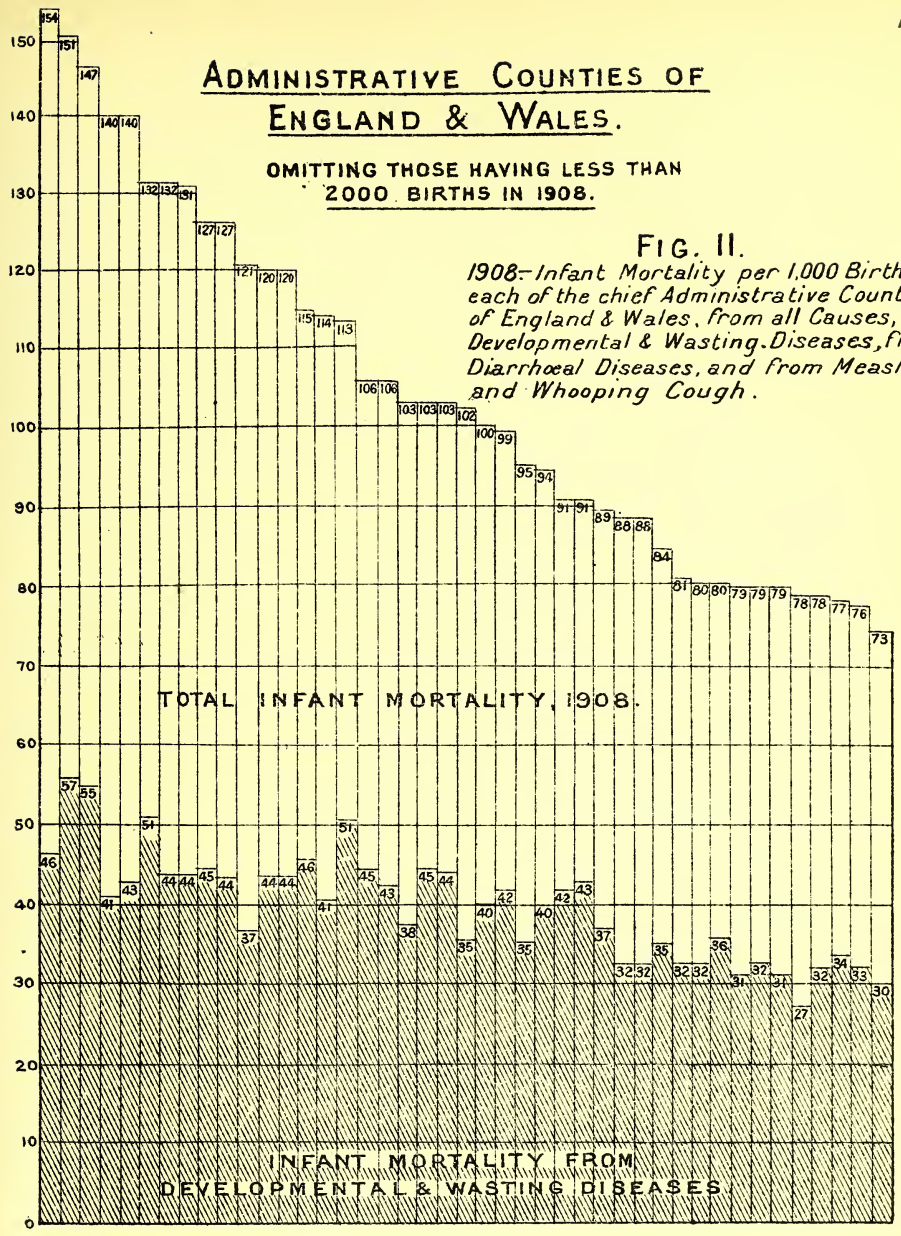
Durham	57·1	Norfolk	45·2
Northumberland ...	55·3	Denbigh	44·7
Stafford	51·3	Lincoln	44·6
Leicester	51·1	Yorks, W. Riding ...	44·3
Glamorgan ... }	46·1	Nottingham	44·2
Yorks, N. Riding }		Cambridge	44·1

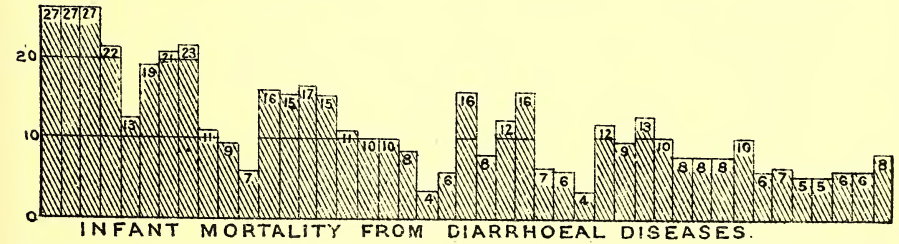
ADMINISTRATIVE COUNTIES OF ENGLAND & WALES.

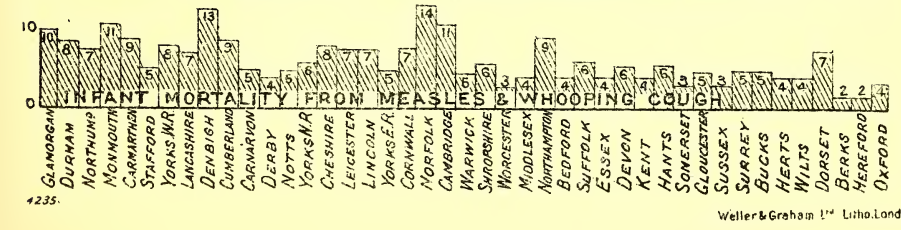
OMITTING THOSE HAVING LESS THAN 2000 BIRTHS IN 1908.

FIG. II.

1908.—Infant Mortality per 1,000 Births in each of the chief Administrative Counties of England & Wales, from all Causes, from Developmental & Wasting Diseases, from Diarrhœal Diseases, and from Measles and Whooping Cough.







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The counties with the lowest death-rates under this head were:—

Wiltshire	27·2	Kent	}	31·7
Oxford	30·0	Somerset		
Surrey	30·9	Buckingham	}	32·1
Hertford	31·3	Dorset		
Devon	31·5	Hereford	32·8	
Gloucester	31·6	Berkshire	33·7	

In the aggregate rural districts the highest death-rates occurred in the following counties:—

Durham	60·1	Cumberland	45·8
Yorks, N. Riding	52·3	Denbigh	45·2
Carmarthen	50·7	Norfolk	45·2
Northumberland	49·4		

The lowest death-rates occurred in the rural districts of—

Monmouth	21·1	Gloucester	29·5
Surrey	28·4	Hertford	29·6
Wiltshire	28·7	Somerset	29·9
Hereford	29·1	Bedford	30·5

In the aggregate urban districts the following stood highest:—

Leicester	64·3	Lincoln	52·1
Northumberland	57·6	Glamorgan	50·0
Durham	54·6	Bedford	49·3
Stafford	53·0		

while the following stood lowest:—

Hertford	32·3	Carmarthen	29·7
Surrey	32·2	Wiltshire	25·3
Berkshire	31·8	Oxford	21·6
Kent	31·3		

In the aggregate county boroughs of the following registration counties the highest death-rates occurred in—

Northumberland	54·4	Monmouth	51·1
Warwick	52·8	Yorks, N. Riding	50·6
Durham	51·8	Norfolk	50·3
Worcester	51·2		

The corresponding minima occurred in—

Hampshire	39·3	Somerset	32·1
Devon	39·1	Berkshire	30·4
Gloucester	35·7	Kent	28·8
Oxford	33·8		

Convulsions.

Notwithstanding the doubt as to the exact meaning which can usually be attached to this word, the death-rate registered as caused by it has much social significance. The table on p. 27, shows that although over one-third of the deaths from convulsions occur before the age of one month is reached, this cause of death is in a larger proportion of cases more closely related to environmental conditions than the developmental and wasting diseases discussed in the last section.

Among the administrative counties the highest death-rates from convulsions were shown in:—

Carmarthen	29·2	Monmouth	15·8
Carnarvon	28·3	Yorks, E. Riding	15·7
Glamorgan	22·0	Denbigh	15·5

while the lowest death-rates occurred in:—

Wiltshire, Kent	5·9	Hampshire	4·9
		Middlesex	4·6
Worcester	5·6	Sussex	4·3
Cambridge	5·0		

In rural districts the death-rates varied between:—

Carnarvon	29·7	Monmouth	14·1
Carmarthen	28·1	Durham	13·8
Glamorgan	23·7	Lincoln	13·6

and—

Hampshire	3·6	Hertford	5·5
Cambridge	4·1	Middlesex	5·9
Sussex	4·8	Somerset	6·1

In urban districts the highest were:—

Carmarthen	31·1	Denbigh	21·4
Carnarvon	26·8	Yorks, E. Riding	19·5
Glamorgan	21·4	Monmouth	16·0

the lowest were:—

Wiltshire	2·3	Worcester	4·6
Sussex	3·8	Norfolk	5·1
Middlesex	4·5	Kent	5·8

In aggregate county boroughs the highest death-rates were in:—

Glamorgan	18·2	Derby	13·3
Monmouth	17·6	Lincoln	12·9
Leicester	15·1	Northumberland	11·3

and the lowest death-rates were in:—

Essex	5·2	Berkshire	2·7
Sussex	4·9	Somerset	2·0
Surrey	4·5	Oxford	1·7
Northampton	4·4		

Diarrhœal Diseases.*

As shown in Figure 11, the counties with the highest total infant death-rate in the majority of cases suffered most from these diseases. The proportion of total infant mortality due to this cause was 18·2 per cent. in Northumberland, 17·8 per cent. in Glamorgan and in Durham, 17·4 per cent. in Lancashire, 16·2 per cent. in the West Riding, 15·8 per cent. in Monmouth, and 14·4 per cent. in Stafford; while it was only 7·3 per cent. in Berkshire, 7·5 per cent. in Hereford, and 3·4 per cent. of the total mortality in Norfolk. These proportions are useful, as indicating the relative importance of diarrhœa in each county; but to compare county with county, the deaths of infants from

* Under Diarrhœal Diseases are included Epidemic Diarrhœa and Enteritis and Gastro-Enteritis.

diarrhœal diseases per 1,000 births must, of course, be stated. These varied in the administrative counties between:—

Glamorgan	27·1	Yorks, W. Riding	21·3
Durham	26·9	Stafford	19·0
Northumberland	26·7	Yorks, N. Riding	16·6
Lancashire	22·7	Derby	16·4
Monmouth	22·1	Warwick	15·7

and—

Norfolk, Suffolk	3·5	Wiltshire	5·0
		Berkshire	5·6
Dorset	4·5	Hereford	5·7

In aggregate rural districts the diarrhœal death-rates varied from:—

Durham	30·1	Monmouth	14·9
Yorks, W. Riding	20·7	Derby	14·2
Northumberland	19·8	Warwick	12·2
Middlesex	17·6	Carmarthen	11·6
Glamorgan	15·5	Kent	11·4

to—

Sussex, Berkshire, Buckingham	3·9	Suffolk	3·6
		Norfolk, Cambridge	2·9
Wiltshire	3·7	Dorset	1·5

In aggregate urban districts the extreme variations were:—

Glamorgan	31·2	Yorks, N. Riding	22·1
Northumberland	29·4	Stafford	21·9
Lancashire	24·4	Yorks, W. Riding	21·5
Durham	24·3	Cheshire, Leicester	18·7
Monmouth	23·1		

and—

Hereford	7·9	Wiltshire, Northampton	6·6
Bedford	7·8		
Hertford	7·3	Norfolk	5·9
Dorset	7·0	Suffolk	3·4

In aggregate county boroughs the variations were from:—

Yorks, N. Riding	41·0	Nottingham	27·0
Yorks, E. Riding	37·3	Leicester	26·1
Essex	29·6	Stafford	25·8
Cheshire	29·3	Glamorgan	25·4
Warwick	28·1	Lincoln	25·2
Lancashire	27·2		

to—

Berkshire	14·1	Sussex	9·6
Oxford	13·5	Kent	8·4
Surrey	12·5	Northampton	7·3
Hampshire	11·4	Somerset	6·0

Measles and Whooping Cough.

These two diseases together caused very unequal infant death-rates in different counties. The two highest were Norfolk, in which 13 per cent., and Denbigh, in which 11 per cent.; the two lowest were Berkshire and Hereford, in which less than 3 per

cent. of the total infant mortality was caused by these diseases. The prevalence of these diseases varies greatly year by year, and a single year's records scarcely justify any statement as to their relative incidence in different communities.

Bronchitis and Pneumonia.

These diseases prevailed very unequally in different administrative counties, the highest death-rates occurring in—

Monmouth	28·7	Derby	24·0
Durham	25·3	Cumberland	23·5
Glamorgan	24·7	Yorks, W. Riding ...	23·4

and the lowest rates in—

Surrey	12·9	Buckingham	12·1
Dorset	12·6	Oxford	10·9

In most of these counties measles and whooping cough were also very fatal during 1908.

In Figure 11 the incidence in the administrative counties of total infant mortality, and of mortality from developmental and wasting diseases, from diarrhœal diseases, and from measles and whooping-cough, are shown so that the relative magnitude of each of these three groups of chief causes of infant mortality can be seen.

As supplementary to this review of the incidence of infant mortality at different ages and from the chief causes of death in the different counties, a statistical summary for each county is given in Appendix II. Under the heading of each county a number of quotations from the reports of county and district medical officers of health and from the reports of medical inspectors of the Board are cited. These quotations can scarcely do justice to the reports from which they have been extracted. In a considerable number of these reports excellent studies of infant mortality are presented; and the short extracts given in the following pages might with advantage have been lengthened and other reports cited which—either because those reports are not sent to me, or from considerations of time and space—have not been able to be quoted.

PART III.

THE CAUSES OF INFANT MORTALITY.

Summary of Parts I. and II.—Before attempting to draw inferences likely to have bearing on possibilities of reform in the districts and counties having excessive mortality in childhood, it is necessary to summarise the main facts ascertained in the preceding inquiry into the statistics of child mortality in England and Wales and its constituent parts. The following facts emerge from the data already presented.

Mortality in the first five years of life is very unequally distributed, the death-rate at these ages in some counties being twice as high as in others. Taking extreme instances, the infant death-rate is twice as high, and the death-rate for the next four years of life is 2¼ times as high, in Glamorgan, Durham, Northumberland, and Monmouth as in Oxford, Hereford, Berkshire, and Wiltshire.

Excessive mortality in infancy implies excessive mortality in later life. This is shown in the statistics of the different counties and sub-divisions of counties in the year 1908 for the ages 0-1 and 1-5. It is also shown for each of the first five years of life in the experience of England and Wales over a long series of years. English statistics show that counties having excessive infant death-rates also on the whole have excessive death-rates throughout the first twenty years of life, and that counties having low infant death-rates have low death-rates throughout the first twenty years of life, though the superiority is not so great at the later as at the earlier ages.

Among the administrative counties, Durham, Norfolk, and Northumberland during 1908 had the highest death-rates within seven days of birth, Hereford, Berkshire, Kent, and Surrey the lowest death-rates. Taking the whole of the first month of life together, Durham, Northumberland, and Carmarthen occupied the worst position, the above rural counties along with Oxford the best position.

In the aggregate of the first three months of life, Northumberland, Durham, Carmarthen, and Glamorgan were worst, while Oxford and Hereford were best. During the second three months of life Glamorgan, Durham, Monmouth, Stafford, and Northumberland were worst, while Gloucester and Dorset were best. In the second half of infancy, Glamorgan, Durham, Monmouth, and Carnarvon were worst, while Hereford, Oxford, and Wiltshire were best. The differences in these extreme instances roughly mean that for equal numbers born, nearly twice as many deaths occur in the first three months of infancy and three times or more than three times as many deaths in the next nine months of infancy in the counties having the most unfavourable as in the counties having the most favourable death-rates.

There does not appear to be sufficient foundation for the statement that prematurity to an increasing extent is a cause of mortality in the English experience. There has probably been much transference of certification between different vague causes of death, and it is safer to consider all these vague conditions together under a common heading. When this is done, evidence of increased death-rate disappears (*see also* p. 26).

When thus grouped, "developmental and wasting diseases" caused nearly twice as high a death-rate in the counties of Durham, Northumberland, Stafford, and Leicester as in Wiltshire.

The death-rate from "Convulsions" varied from 28 to 29 per 1,000 births in Carnarvon and Carmarthen to not much more than 4 per 1,000 in Sussex and Middlesex.

Diarrhœal diseases caused a death-rate among infants which for instance was nearly eight times as high in Durham and Glamorgan and Northumberland as in Norfolk and Suffolk, five times as high in Lancashire, Monmouth, and the West Riding as in Dorset, and nearly four times as high in Stafford as in Wiltshire.

Bronchitis and pneumonia caused a death-rate among infants, which was twice as high in Monmouth, Durham, Glamorgan, Derby, Cumberland, and the West Riding as in Surrey, Dorset, Bucks and Oxford.

Correlation between the Infant Death-rates at different periods of the First year of Life and from different Causes.

Although the iteration in Part II. of certain counties and parts of counties, as always having consistently high or low death-rates under each heading, cannot have escaped observation, it is difficult without some general conspectus to realise to what extent these consistencies exist. Our first attempt must, therefore, be to show more clearly the relationships between the death-rates under these different headings. In the following tabular statement a first attempt towards such a conspectus is made.

Relative Infant Mortality Figures of 43 *Administrative Counties of England and Wales based on the experience of* 1908.

	Certain Administrative Counties in order of magnitude of Total Infant Mortality.	Under 1 week.	Under 1 month.	Under 3 months.	3–6 months.	6–12 months.	Developmental and wasting diseases.	"Convulsions."	Diarrhœal diseases.	Bronchitis and pneumonia.
	ENGLAND AND WALES ...	100	100	100	100	100	100	100	100	100
14 Counties with Highest Total Infant Mortality.	Glamorgan	102	114	119	147	133	111	204	136	121
	Durham	139	130	121	131	130	137	121	135	124
	Northumberland	135	131	123	120	123	133	124	134	106
	Monmouth	96	99	110	120	127	98	147	112	141
	Carmarthen	118	118	120	93	128	102	271	63	104
	Stafford	116	116	113	117	97	124	116	96	97
	Yorks, W. Riding	112	109	105	112	115	107	122	107	115
	Lancashire	106	105	106	113	110	105	84	115	107
	Denbigh	121	115	113	116	82	108	144	55	100
	Cumberland	121	113	107	107	100	105	95	47	116
	Carnarvon	108	101	119	97	67	105	263	33	83
	Derby	107	101	100	98	102	106	95	92	118
	Nottingham	105	107	103	101	92	106	124	76	101
	Yorks, N. Riding	115	110	101	92	88	111	104	83	76
	Average Death-rates for the above 14 Counties.	27·8	45·4	71·4	27·6	36·6	47·1	13·5	21·4	22·7
	Relative Mortality Figures for the above 14 Counties.	114	113	111	117	113	113	125	108	111

NOTE.—The order of names is that of the amount of the total infant mortality in 1908, beginning with the highest. The numerical position of each county in each column for the special death-rate concerned is its position in proportion to the same special death-rate of England and Wales stated as *100*.

	Certain Administrative Counties in order of magnitude of Total Infant Mortality.	Under 1 week.	Under 1 month.	Under 3 months.	3–6 months.	6–12 months.	Developmental and wasting diseases.	"Convulsions."	Diarrhœal diseases.	Bronchitis and pneumonia.
15 Counties with Medium Total Infant Mortality.	Cheshire	95	94	93	104	90	98	105	75	91
	Leicester	117	110	102	95	78	123	93	54	78
	Lincoln	106	99	92	86	82	107	120	48	73
	Yorks, E. Riding	111	104	95	75	83	103	146	49	81
	Cornwall	114	102	96	84	66	90	98	42	81
	Norfolk	125	106	97	64	78	109	74	18	75
	Cambridge	117	107	96	63	80	106	47	29	78
	Warwick	86	85	88	93	71	84	81	79	75
	Shropshire	109	99	92	78	70	97	93	40	109
	Worcester	101	96	89	89	64	100	52	60	107
	Middlesex	84	82	79	83	76	83	43	78	78
	Northampton	114	104	91	64	64	96	60	33	75
	Bedford	99	94	92	65	52	101	84	32	69
	Suffolk	107	98	87	60	65	103	75	18	65
	Essex	94	93	83	65	64	89	58	39	68
	Average Death-rates for the above 15 Counties.	24·2	38·1	57·1	18·8	23·6	39·7	8·0	11·2	15·6
	Relative Mortality Figures for the above 15 Counties.	100	95	89	80	73	95	75	57	76
14 Counties with Lowest Total Infant Mortality.	Devon	89	84	78	70	67	76	88	45	71
	Kent	76	79	78	67	66	76	55	65	72
	Hampshire	92	90	80	62	53	84	46	51	66
	Somerset	101	91	76	55	59	76	63	40	73
	Gloucester	95	86	80	45	55	76	58	39	70
	Sussex	102	89	76	53	57	87	40	39	65
	Surrey	77	79	73	62	55	74	58	49	63
	Buckingham	103	92	79	49	51	77	67	30	59
	Hertford	84	83	74	55	56	75	73	36	66
	Wiltshire	97	91	78	55	46	65	55	26	72
	Dorset	89	87	75	42	60	77	75	23	62
	Berkshire	77	80	72	51	57	81	72	29	64
	Hereford	75	78	68	70	49	79	64	29	70
	Oxford	86	76	69	56	47	72	70	41	53
	Average Death-rates for the above 14 Counties.	21·2	33·9	49·2	13·9	18·7	32·0	6·5	8·8	13·7
	Relative Mortality Figures for the above 14 Counties.	88	84	77	59	58	77	61	45	68

NOTE.—The order of names is that of the amount of the total infant mortality in 1908, beginning with the highest. The numerical position of each county in each column for the special death-rate concerned is its position in proportion to the same special death-rate of England and Wales stated as 100.

This table deals with 43 administrative counties.* They are given in order of demerit, beginning with the county having the highest total infant death-rate. The counties are arranged in three groups, and in each group the relative position of each

* Only those counties are selected in which more than 2,000 births occurred in 1908.

county is given in respect of the death-rate for five groups of ages under one year, and for four chief groups of causes of death, the corresponding position of England and Wales under the same heading being stated as 100.

Certain approximate conclusions can be drawn as to these administrative counties, before summarising the experience embodied in them more accurately by means of co-efficients of correlation.

Glamorgan stands extremely high at each age except the first week of life* and from each of the four groups of causes of death; Durham's position is consistently and terribly bad throughout. Northumberland is but little better than Durham and Glamorgan.

Monmouth has a relatively favourable position in respect of developmental and wasting diseases and a correspondingly low death-rate under one month of age, but it has the highest death-rate from bronchitis and pneumonia of any county.

In Carmarthen, as in Carnarvon, convulsions appear as a much higher cause of mortality than in other counties. There is little doubt that some of these deaths should have been returned under the heading of developmental and wasting diseases.

Stafford has a high death-rate under every heading, except from diarrhœal and respiratory diseases. In the West Riding of York the death-rate is high from all the tabulated causes of death.

Lancashire has a somewhat high death-rate under the age of one month and from developmental and wasting diseases, and a still higher death-rate in the second half of the first year of life and from diarrhœa. The other counties named in the list of demerit tell their own story. The most interesting outcome of this comparison is the common association in these counties between (1) a high infant mortality under one month, and (2) a high mortality in the remaining months of the first year of life, and a high mortality from diarrhœa and from respiratory diseases; a similar relationship holding good in regard to low death-rates.

This conclusion can be more exactly stated for all the 43 counties considered by means of *co-efficients of correlation.*

Co-efficients of correlation express by means of a fraction the degree of relationship or kinship between series of phenomena under comparison. If the phenomena exactly correspond, the co-efficient = 1; if there is no correspondence, the co-efficient = 0, and intermediate degrees of correlation are counted by intermediate decimal fractions. If the co-efficient approaches unity, the two phenomena are almost certainly causally related, either directly, or indirectly through a third phenomenon. As it is rare for two groups of phenomena to be free from disturbing influences, the co-efficient of correlation may be much below unity, and yet there may be a causal connection between the two. The magnitude of the "probable error," which is given after each co-efficient stated below gives a further clue as to the importance to be attached to the co-efficient of correlation.

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* The low mortality in Glamorganshire during the first week of life contrasts remarkably with its position in the rest of infancy. This fact and the very high proportion of still-births in Rhondda (*see* footnote, p. 50) suggest the need for inquiry as to whether some live births followed by early death may not have escaped registration.

Co-efficient of Correlation between—

(1) Death-rate under 1 month and death-rate at age 6-12 months in 43 counties* ... = ·68 ± ·035

(2) Death-rate from Premature Birth *plus* Congenital Defects, and death-rate from Diarrhœal Diseases in 43 counties ... = ·24 ± ·097

(3) Death-rate from Premature Birth *plus* Congenital Defects, and death-rate from Bronchitis *plus* Pneumonia in 43 counties ... ... = ·18 ± ·100

(4) Death-rate from all causes under 1 month and death-rate from Diarrhœal Diseases in 43 counties ... ... = ·55 ± ·072

(5) Death-rate from all causes under 1 month and death-rate from Bronchitis *plus* Pneumonia in 43 counties ... ... = ·68 ± ·055

The high co-efficient of correlation between the death-rate from all causes under 1 month and the death-rate at 6-12 months shows the intimate connection between the two.

There is the same degree of correlation between the total death-rate under 1 month and the death-rate from bronchitis and pneumonia, and a slightly lower correlation with the death-rate from diarrhœal diseases in infancy.

On the other hand, the correlation between the death-rate from premature birth and congenital defects and from the same two groups of diseases (diarrhœal and respiratory) is much lower. It may be inferred that a considerable share of infant mortality within the first month of life is due to other than pre-natal causes, which, like bronchitis and pneumonia, come within the range of preventive medicine; and that if counsel and ameliorative measures are postponed until after registration of births has been secured—the legal limit for which is six weeks—they will to that extent be too late to be useful.

The Degree of Preventibility of Infant Mortality at different stages of Infancy.

The preceding table and the co-efficients of correlation given above throw considerable light on the extent to which measures directed towards reducing infant mortality may be expected to be successful in early and late infancy respectively. The average death-rates set out for the three groups of counties in the table on pp. 36 and 37 show the percentage differences between the death-rates in grouped counties of high, medium, and low infant mortality.

At ages under one week, the death-rate in the 14 best counties is 12 per cent. below, and in the 14 worst counties is 14 per cent. above, that of England and Wales.

At all ages under one month, the corresponding death-rates are 16 per cent. below and 13 per cent. above that of England and Wales; at all ages under 3 months 23 per cent. below and

* The 43 counties used in obtaining this result are those in each of which more than 2,000 births were registered during 1903.

11 per cent. above; at ages 3-6 months 41 per cent. below and 17 per cent. above; and at ages 6-12 months 42 per cent. below and 13 per cent. above that of England and Wales as a whole. Evidently the difference between good and bad counties increases with each month of life, though it is already sufficiently great in the first month of life to point to possible reductions in mortality under improved conditions of birth and life.

Similarly taking groups of diseases, under the head of developmental and wasting diseases the death-rate in the 14 best counties is 23 per cent. below, and in the 14 worst counties is 13 per cent. above, that of England and Wales; from convulsions the corresponding death-rates are 39 per cent. below and 25 per cent. above the rate for England and Wales; from diarrhœal diseases 55 per cent. below and 8 per cent. above; and from bronchitis and pneumonia 32 per cent. below and 11 per cent. above that of England and Wales as a whole.

A more general review may now be taken of the factors influencing infant mortality.

These may be classified into *pre-natal,* acting through the mother and dependent on her health; *natal,* and still in large measure due to the condition of the mother, *e.g.*, causes of difficult parturition, though the skill of the doctor or midwife is also largely concerned; and *post-natal,* which arise from environmental conditions.

It has been already seen that in the counties of England and Wales showing excessive or low infant mortality, these different causes of high or low mortality are acting together to such an extent as to be almost inextricable. I prefer, therefore, for the present, to accept the tangle and to discuss the factors of infant mortality apart from any such attempt at separation.

Among the influences affecting infant mortality are the following. They are not given in order of importance.

1. The proportion of male to female births.
2. The proportion of legitimate to illegitimate births.
3. The magnitude of the birth-rate, which may for the present purpose be otherwise put as the size of the family.
4. The number of still-births.
5. The quality of the help given at birth.
6. The age of the wife at marriage.
7. Poverty and social conditions.
8. The extra-domestic employment of married women.
9. Urban or rural conditions of life.
10. Domestic and municipal sanitation.
11. Conditions of housing.
12. Ignorance and fecklessness of mothers.

Obviously the above list is incomplete, and still more obviously the different factors overlap at various points. It will only be practicable here to mention briefly some of the chief points under each head. It will be noted that climatic conditions have been omitted. If a curve of the mean temperature of the third quarter of each year were drawn under the curve of the annual infant mortality in Figure 7 the two curves would be found to rise and fall in the same years owing chiefly to the excessive

prevalence of fatal diarrhœa in hot summers. The close relationship between weather and infant mortality has led many to doubt whether the reduced infant mortality of recent years represents more than a cyclical wave of favourable seasons. A short consideration of this decrease throws some light on the factors which we are studying.

The Decrease of Infant Mortality in England.

Figure 7, the extended table on page 142, and the summary table on page 15 show the exceptional extent of the decline of infant mortality in recent years. As is well known, and as is shown in Figure 7, there had been little or no continuous fall in the rate of infant mortality up to the year 1899. Since that year a considerable fall has occurred, which, as Dr. Stevenson shows, is "common to the experience of most European countries during the same period."* As already mentioned the rates of infant mortality are probably vitiated to an uncertain extent by increasing completeness in certification of deaths occurring during the first day or week of life, which were formerly treated as still-born; and it is likely, therefore, that the reduction of infant mortality in recent years is somewhat greater than the official figures show.

The rate of infant mortality for a series of years in England and Wales and in certain other countries is shown in the following table taken from the Registrar-General's report:—

——	England and Wales.	France.	Prussia.	Norway.	New South Wales.	New Zealand.
1881–85 ...	139	167	207	99	124	90
1886–90 ...	145	166	208	96	115	84
1891–95 ...	151	171	205	98	111	87
1896–1900 ...	156	159	201	96	113	80
1901–05 ...	138	139	190	81	97	75
1906... ...	132	143	177	69	75	62
1907... ...	118	—	168	67	89	89
1908... ...	120	—	173	—	76	68
1909... ...	109	—	—	—	—	—

It is doubtful if the infant death-rates in these different countries are strictly comparable, owing to differences in the registration of births and deaths; but the fluctuations of the rates in each country show that to some extent the causes producing decline have been acting in the countries enumerated above, as well as in this country.

In this connection a comparison between the three parts of the United Kingdom is interesting. Ireland, the poorest country of the three, has always occupied the most favourable position. England and Wales, which until recently has suffered from a much higher infant mortality than Scotland, has now approximated towards the position of the latter country (*see* Fig. 12, facing page 8).

* Annual Report of Registrar-General of Births and Deaths for 1908, page cxxi.

The improvement in the three countries, comparing the seven years 1902-8 with the seven years 1895-1901, is as follows:—

	Mean Infant Mortality.		Percentage Decrease.
	1895–1901.	1902–1908.	
			Per cent.
England and Wales	156	130	16·7
Scotland	130	116	10·8
Ireland	105	96	8·6

In considering the greater percentage improvement of England than of Scotland and Ireland, as shown above, its ampler scope for improvement will not be forgotten.

Much light is thrown on the possible causes of the decline in infant mortality by a consideration of its incidence according to age and according to cause of death.

Changes in age-incidence of infant mortality.

In 1891 the death-rate per 1,000 births at ages under 3 months was 72·8; in 1908 it had become 64·4. In 1891 the death-rate at ages 3-6 months was 29·7; in 1908 it had become 23·6. In 1891 the death-rate at ages 6-12 months was 46·1; in 1908 it had become 32·4. The changes that have occurred year by year at each of these ages are shown in the following table extracted from the Registrar-General's reports:—

England and Wales.—Infant Death-rates per 1,000 *Births, and Relative Mortality Figures, at ages* 0–3, 3–6 *and* 6–12 *Months in the years* 1891–1908.

Year.	Death rates.			Relative mortality figures, death-rates for 1891 being stated as 100.		
	0–3 months.	3–6 months.	6–12 months.	0–3 months.	3–6 months.	6–12 months.
1891	72·8	29·7	46·1	100	100	100
1892	72·3	29·8	45·4	99	100	99
1893	77·4	34·3	47·0	106	116	102
1894	69·2	26·7	40·9	95	90	89
1895	75·9	34·8	49·9	104	117	108
1896	72·5	30·7	44·3	100	104	96
1897	73·4	33·4	49·0	101	113	107
1898	75·1	35·2	50·1	103	119	109
1899	76·9	35·7	50·0	106	120	109
1900	74·2	32·7	47·3	102	110	103
1901	74·8	32·0	44·5	103	108	97
1902	68·4	25·8	38·7	94	87	84
1903	67·6	26·2	37·8	93	88	82
1904	70·9	30·1	44·3	97	102	96
1905	66·6	24·8	36·8	92	84	80
1906	67·6	27·0	37·9	93	91	82
1907	64·0	21·3	32·3	88	72	70
1908	64·4	23·6	32·4	89	80	70

At ages under 3 months the death-rate was 11 per cent., at ages 3-6 months 20 per cent., and at ages 6-12 months 30 per cent. below that of 1891. Before 1900 the lowest death-rate in the table occurred in 1894; and the death-rates in 1908 were 6 per cent., 11 per cent., and 21 per cent. lower at each successive period of infancy in 1908 than in the corresponding periods of 1894. Thus improvement has been greatest in the second half, though it is also considerable in the first half of infancy.

The comparison for the first three months of life can be pursued further for four years only, as shown in the following table from the Registrar-General's reports:—

England and Wales.—Infant Death-rates per 1,000 *Births during the first three months of life.*

Year.	Under 1 week.	1–4 weeks.	1–3 months.	Entire 3 months.	3–6 months.	6–12 months.
1905 ...	25·2	16·6	24·8	66·6	24·8	36·8
1906 ...	25·0	16·9	25·7	67·6	27·0	37·9
1907 ...	24·4	16·3	23·3	64·0	21·3	32·3
1908 ...	24·3	16·0	24·2	64·4	23·6	32·4

There is evidence of slight decline of death-rate even in the early weeks of life, but it is small as compared with the decline in the later part of infancy.

Changes in infant death-rate from different causes.

A comparison of 1908 with the average of the five preceding years, shows that the common infectious diseases showed a reduction from 8·3 to 7·4 deaths per 1,000 births, or 11 per cent.; diarrhœal diseases from 22·6 to 19·9 or 12 per cent.; "wasting diseases" (including premature birth, etc.) from 43·8 to 42·4 or 3 per cent.; and miscellaneous diseases from 51·1 to 46·1 or 10 per cent.

Some of these causes of death are not such as are supposed to be influenced by differences of weather. That such differences do not entirely account for the improvement is further indicated by a closer study of the relationship between the total infant mortality and still more of the mortality from infantile diarrhœa during the last fifteen years and the temperature and rainfall in each summer month of these years. As elsewhere shown† there is a general inverse relationship between rainfall and diarrhœa, and a direct relationship between temperature and diarrhœa; and if accurate and continuous meteorological observations were kept in every town, it would be possible to arrange the towns

* Ann. Rep. Reg.-Gen., 1908, p. 84.

† A Contribution to the Study of Epidemic Diarrhœa, *Public Health*, Dec., 1899.

approximately in the order in which they should appear *re* diarrhœa, and contrast this with the actual position of each town.

It is convenient to add at this point that the relative position of such administrative counties as Glamorgan, Lancashire, Monmouth, and the West Riding in respect of diarrhœal mortality (see page 33) would be made worse were due allowance made for the fact that in these counties as a rule there is more rain and a lower summer temperature than in many of the counties with low diarrhœal mortality.

At present, however, we are concerned with comparing not different parts of the country, but England and Wales with itself in recent and in more distant years. A careful analysis of the monthly rainfall and temperature at Greenwich in successive years does not appear to afford a sufficient explanation of the unexampled fall in infant mortality during the last three years.

The analysis need not be reproduced here. The test will be furnished in this or in subsequent years by actual events. Whether the rise in the infant mortality associated with deficient summer rainfall and excessive temperature will in the future be as great as, or on a smaller scale than, in the past remains to be seen. The evidence in my view points to the conclusion that the second alternative will prove to be correct.

The conclusion that something beyond favourable seasons has aided the recent decline in infant mortality is confirmed by the general shape of the curve in Fig. 7. It will be noted that the most recent maximum mortality (in 1904) and the most recent minimum mortalities (in 1907 and 1909) are both on a lower level than any of the maximum and mimimum death-rates of former years, although no corresponding differences in climatic conditions are seen.

Dr. Stevenson remarks "it is difficult to avoid connecting this satisfactory tendency" (to decline in infant mortality) "with the quickening of the public conscience upon the subject of late years." The decline may, I think, in large measure be ascribed to this cause. Doubtless the instinct of national self-preservation has borne an important share in this quickening, the decline in the birth-rate having aroused serious attention to the subject.

Other factors in the decline of infant mortality are discussed in the following pages. A careful review of the experience of the last few years will be found to give a high place to the higher standard of education, especially in its moral aspects, which has been secured in recent years. In attaining thus far, the National Conferences on Infant Mortality in 1906 and 1908 have had great educational influence. The Notification of Births Act, 1907, crystallised public opinion on the subject. This public opinion has had effect in many sanitary districts in which the Act has not hitherto been adopted; for health visitors and voluntary associations as well as the sanitary officials already engaged in public health work have been concentrating on the problem of infant mortality, and aiding to secure the "sanitary conscience" whose full development is required to arrest preventible mortality in infancy as in the rest of life.

Factors of Infant Mortality.

Proportion of Male to Female Infant Mortality.

The vital superiority of women is evidenced from birth onwards, for male infants always suffer from a higher death-rate than female infants, and this superiority persists throughout the rest of life, except at the ages 5 to 15 when boys and girls are equal in their freedom from the causes of death. In 1908 in England and Wales male infants had a death-rate which was 24 per cent. above that of female infants.

As shown in Fig. 13 the excess of male over female mortality for equal numbers born is greatest in the first and second months of life, when it is over 30 per cent. It then steadily declines, the excess being only about 7 per cent. in the twelfth month of life. During the second year the corresponding excess is 8 per cent., in the third year 6 per cent., in the fourth year 2 per cent., and in the fifth year it has disappeared.

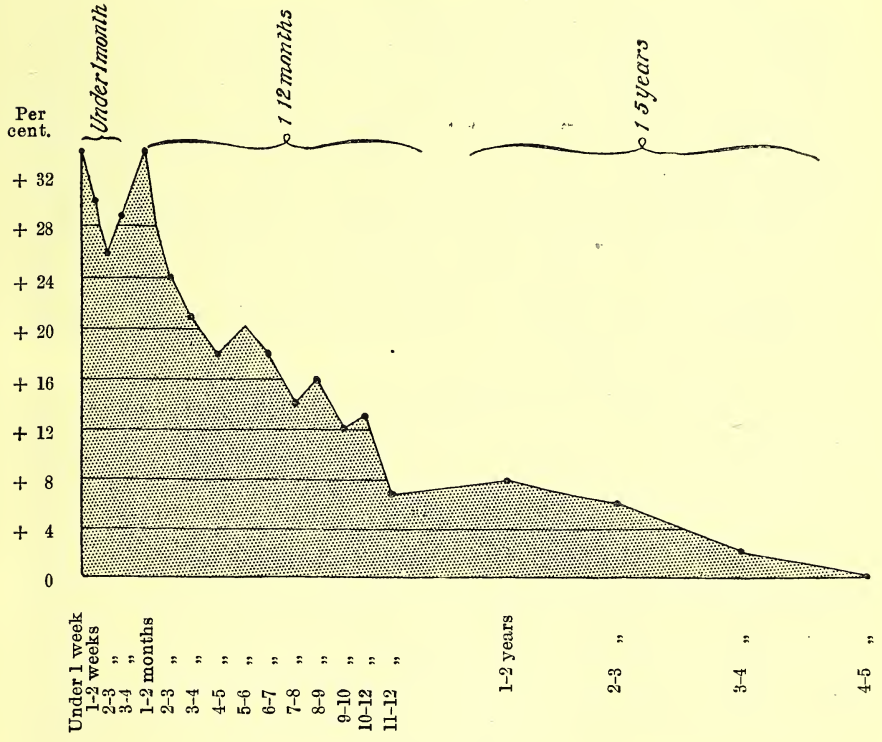

Fig. 13.

Excess of Male over Female Death-rate at various ages under one year, and 1–5 *years. (Based on tables* 33 *and* 34 *in the Registrar-General's Annual Report for* 1908.)

Among causes of death, the only disease which, in accordance with experience in other years, was less fatal among male than among female infants, was whooping-cough. Deaths from premature birth among equal numbers of the two sexes were 26 per cent., congenital defects 27 per cent., atrophy, debility,

and marasmus 28 per cent., convulsions 32 per cent., diarrhœal diseases 20 per cent., and bronchitis and pneumonia 27 per cent. more fatal among male than among female infants.*

It can scarcely be assumed that in the first months of life boys have larger opportunities for getting into mischief than girls. Some of this difference in vitality between the two may be explicable, by the greater difficulty with which male infants are born, owing to their larger average cranium. The excess of still-births among male infants and the fact that the death-rate on the first day of life in England and Wales in 1908 was 34 per cent. higher among male than among female infants, points to this conclusion. Parturition is well known to be more difficult with male than with female infants. Some other unknown influence must be assumed to be the cause of the persistent excess of the male death-rate, during the later months of infancy, which continues to a less extent during the next four years of life.

Proportion of Male to Female Births.

In 1881-85 the proportion of births of males to 1,000 births of females was 1,039, and in 1906-08 the proportion was the same. Clearly then a smaller proportion of male births has borne no share in reducing infant mortality. Nor do discrepancies in the proportion of male to female births account for any appreciable share of the variations in the infant death-rates in the different counties. For although in Oxfordshire the proportion of male births in 1908 was as low as 984 and in Hertford 997, it was 1,025 in Dorset and 1,002 in Wiltshire (all counties with low infant mortality); and it was only 1,030 in Durham, 1,032 in Northumberland and 1,039 in Glamorgan (counties of highest infant mortality) as compared with the average of 1,036 in England and Wales as a whole.

The Proportion of Legitimate to Illegitimate Births.

Taking the average for England and Wales, the death-rate among illegitimate children is twice that of children born in wedlock. Again quoting the national figures, it is significant that under 3 months of age the prospect of death is 108 per cent. greater, at ages 3-6 months is 126 per cent. greater, at ages 6-12 months is 72 per cent. greater among illegitimate than among legitimate infants. The proportion of illegitimate births in 1,000 total births in England and Wales in 1881-85 was 48, in 1906-08 it was 40. The difference is too small to have had more than a small share in producing the fall in the total rate of infant mortality. Nor is there any obvious relationship between the present magnitude of infant death-rate and of illegitimate birth-rate in different counties. If the mean infant mortality in registration counties for 1898-1907 be plotted out in comparison with the corrected illegitimate birth-rate for the year 1901,† it

* See table on p. cxxiv of Dr. Stevenson's contribution to Ann. Rep. of Reg. General, 1908.

† 1901 has been selected, because for that year statistics showing the total and illegitimate birth-rates corrected for the number and ages of married and unmarried women in the respective populations had been calculated. (*See* "The Decline of Human Fertility," &c., by A Newsholme and T. H. C. Stevenson, *Journ. Roy. Statist Soc.*, Vol. LXIX., Pt. I., 1906.)

will be seen that there is no obvious connection between the two. The curve is not reproduced here; but the facts are given in the following table for the counties having the highest and lowest infant death-rates respectively along with the corresponding total birth-rates. In order to facilitate comparisons between the three columns of this table, the rates are stated as relative mortality figures, England and Wales in each column equalling 100.

England and Wales.—Relative mortality figures of Infant Mortality 1898–1907. *Relative corrected Birth-Rate figures, and Relative corrected Illegitimate Birth-Rate figures in certain Registration Counties in* 1901.*

	Relative Figures of		
	Infant Mortality.	Total Birth-rate.	Illegitimate Birth-rate.
Lancashire	122	99	96
Durham	114	116	136
Glamorgan	114	113	108
Nottingham	112	106	151
Warwick	110	100	89
Northumberland ...	109	110	117
Yorks, West Riding ...	108	95	111
Yorks, East Riding ...	108	100	141
Monmouth	102	121	98
Leicester	102	96	98
Yorks, North Riding ...	101	112	135
Cheshire	100	100	92
Surrey	79	94	66
Cambridge	78	100	119
Sussex	76	88	76
Shropshire	75	117	162
Berks	74	99	103
Hereford	72	110	141
Bucks	72	105	111
Somerset	72	97	69
Hertford	71	101	92
Oxford	70	101	107
Dorset	67	99	83
Wiltshire	65	100	106
England and Wales	**100**	**100**	**100**
England and Wales Actual rates per 1000	142	28·4	1·12

* These are not rates but relative mortality figures. For the actual rates see the paper referred to in the footnote on page 46. Or they may be calculated from the rates given on the last line of the above table.

It is evident that there is no constant relation between total infant mortality and the magnitude of the illegitimate birth-rate. Shropshire has an illegitimate birth-rate 62 per cent. higher than that of England and Wales, while its infant death-rate is 25 per

cent. below the same standard. In Nottinghamshire the illegitimate birth-rate is 51 per cent. in excess, the infant death-rate 12 per cent. in excess. In the East Riding of York the illegitimate birth-rate is 41 per cent. in excess, the infant death-rate 8 per cent. in excess. In Lancashire the illegitimate birth-rate is 4 per cent. below the average, the infant death-rate 22 per cent. above the average of England and Wales. These discrepancies do not, of course, imply that illegitimacy is not a cause of excessive mortality among infants, still less that additional supervision of such infants is unnecessary, but only that illegitimacy as influencing total infant mortality is a minor factor compared with the factors dealt with in the following pages.

The size of family in relation to infant mortality.

The size of family is of importance in relation to infant mortality. It is often stated that moderately small families conduce to low infant mortality. The Registrar-General, on p. lxix. of his report for 1905, states: "There is . . . some ground for the opinion that moderate birth-rates associated with low mortality among children may be more effective towards the up-keep of the population than high birth-rates associated with high mortality among children." These words do not necessarily imply an essential connection between high birth-rate and high infant mortality, but the notion that such an essential connection exists is commonly entertained.

A priori the tendency should be in the opposite direction. Although our national statistics do not supply information as to the relative death-rates among children of the same family, it is well-known that the death-rate is higher among the first-born than among subsequent infants; and large families should, therefore, on an average have a slightly lower infant death-rate. The matter can be tested in the table on page 47, in which birth-rates calculated on populations duly corrected for the number of married couples at child-bearing ages are compared with infant death-rates. It will be observed that among the twelve registration counties in the list having an infant death-rate equal to or greater than that of England and Wales, the birth-rate varied from 5 per cent. below to 21 per cent. above that of England and Wales; while among the twelve counties having each of them an infant death-rate more than 20 per cent. below that of England and Wales, the birth-rate varied from 12 per cent. below to 17 per cent. above that of England and Wales. Comparisons of single counties show striking differences between the height of the infant death-rate and of the birth-rate. Thus although in Durham, Glamorgan, and Northumberland both were in excess to about the same extent, the birth-rate in the West Riding of York was 5 per cent. below and its infant death-rate 8 per cent. above the average, the birth-rate of Lancashire was 1 per cent. below, and its infant death-rate 22 per cent. above the average. In Shropshire again the birth-rate was 17 per cent. above, and its infant death-rate 25 per cent. below the average; and in Hereford an excess of 10 per cent. under the first head was associated with a deficiency of 28 per

cent. under the second. The most striking illustration, though outside the scope of this report, is furnished by Ireland. In 1901* it had a corrected birth-rate of 36·1 per 1,000, as compared with 28·4 in England and Wales. This means that in Ireland families were on the average much larger than in England. In the same year its infant mortality was 101 per 1,000 births, as compared with 151 in England and Wales (*see also* p. 60).

Similarly a survey of the progress of infant mortality and of birth-rate in different parts of England and Wales furnishes illustrations of the facts that a fairly stationary birth-rate and a declining birth-rate may both of them be associated with a large decline in infant mortality. The illustrations in the following table are taken from the Registrar-General's Annual Summary.

	Birth-rates.		Infant Death-rates.	
	1901.	1909.	1901.	1909.
West Ham	35·2	27·2	171	124
Plymouth	26·8	22·4	149	131
Bristol	27·0	22·6	131	100
Leeds	30·0	22·8	188	122
Huddersfield	22·9	24·5	132	95
Halifax	22·5	16·5	127	97
Liverpool	32·1	31·1	188	144
Portsmouth	27·9	27·2	163	96

The relation between birth-rate and infant mortality has been further tested by calculating the *coefficient of correlation* given below. For this purpose it was necessary to use corrected birth-rates, and the figures for 1901 were taken from the paper referred to on page 46. These related to 46 registration counties. The coefficient of correlation between these birth-rates and the infantile death-rate for 1901-05 in the same counties is represented by the fraction ·36. (For remarks on coefficients of correlation see page 38.)

Large families evidently do not necessarily imply a tendency to high infant mortality. They should *ceteris paribus*, except in circumstances of extreme poverty, have an opposite effect to a slight extent. The connection often observed between a high birth-rate and a high rate of infant mortality probably is due in great part to the fact that large families are common among the poorest classes, and these classes are specially exposed to the degrading influences producing excessive infant mortality.

The Number of Still-births.

Note has already been made of the unfortunate fact that in this country still-births remain unregistered. A partial step

* *Loc. cit.*, p. 41. This corrected birth-rate is in marked contrast to its crude birth-rate of 23·1 per 1,000 of population.

in the direction of reform has been taken by making it obligatory on midwives—who attend probably about one half of the births in England and Wales—to notify all still-births; and by imposing a similar obligation in regard to all births occurring after the expiration of the 28th week of pregnancy on persons present at the birth in districts in which the Notification of Births Act has been adopted. This provision is by itself a strong argument for the general adoption of the Notification of Births Act. The disturbing influence of increasingly complete registration of births and of deaths which occur in the early days of life has already been mentioned (pp. 26 and 41). The subject need not be pursued further here, except to say that there is no completely satisfactory evidence of a general increase of still-births, and such an increase does not fit in with what appears to be likely to prove the true interpretation of the death-rate from prematurity of birth (page 30).*

The Quality of the Help given at Birth.

Taking extreme instances, in Durham and Northumberland 1 of every 30 infants born, and in Hereford and Kent only 1 of every 54 to 55 infants born, dies within a week of birth. These facts suggest that differences in care at birth may bear an important part. If so, the difference would be likely to express itself also in differences of death-rate from developmental and wasting diseases, and in differences of death-rate during the first month of life. The administrative counties of Northumberland, Durham, Carmarthen, Stafford, Denbigh, and Glamorgan have the highest death-rates under 1 month; and Durham, Northumberland, Stafford, Leicester, and Glamorgan have the highest death-rates from developmental and wasting diseases. These counties would be expected, therefore, on the above hypothesis to have the least satisfactory arrangements for attendance on parturient women. There is, however, at present no evidence as to this. The high death-rate for the first week of life in some of the counties having a chiefly rural population also suggests the possibility of difficulty in obtaining efficient help for women in labour.

In counties having insufficient arrangements for helping women in child-birth, there will almost certainly be a high proportion of incompetent help; and it may be expected, therefore, that such counties will have an excessive death-rate from puerperal sepsis and the accidents of child-birth.

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* Dr. Jenkins, the medical officer of health of Rhondda urban district, gives the following interesting statistics of still-births and of deaths from premature birth in that district. The statistics of still-birth are obtained from a record of the number of still-born children brought to the three cemeteries for burial during the years in question.

Six-yearly period.	Still-births. Average rate per 1,000 births.	Deaths from premature birth per 1,000 births.
1897–1902	64·3	14·2
1903–1908	68·8	14·8

The Registrar-General gives statistics of the death-rate per 1,000 births from these complications of child-birth for registration counties. Unfortunately these statistics are only roughly comparable with the statistics in this report for administrative counties; but by giving the infant death-rates under one month and from developmental and wasting diseases for both administrative counties and for county boroughs an approximate comparison can be made. As the number of deaths from puerperal sepsis and the accidents of child-birth are relatively few, the death-rates for ten years (1897-1906) have been taken. The comparison thus made is shown in the following table. Three groups of ten administrative counties have been made, comprising those

Counties with highest, medium, and lowest infant death-rates per 1,000 births in 1908.					
	Under one month.		From developmental and wasting diseases.		Registration counties, death-rates from puerperal sepsis and accidents of childbirth, 1897–1906 per 1,000 births.
	Administrative counties.	County boroughs.	Administrative counties.	County boroughs.	
Counties with highest infant mortality.					
Northumberland	53	52	55	54	4·5
Durham ...	52	44	57	52	4·7
Carmarthen ...	47	—	43	—	6·2
Stafford ...	47	45	51	44	4·7
Denbigh ...	46	—	45	—	7·1
Glamorgan ...	46	42	46	43	6·1
Cumberland ...	45	—	44	—	5·4
Yorks, N.R. ...	44	42	46	51	4·4
Leicester ...	44	37	51	42	3·8
Yorks, W.R. ...	44	45	44	47	5·1
Counties with medium infant mortality.					
Cornwall ...	41	—	38	—	4·5
Carnarvon ...	41	—	37	—	5·6
Derby	41	36	44	43	4·7
Lincoln ...	40	33	45	41	4·3
Shropshire ...	40	—	40	—	3·8
Monmouth ...	40	46	41	51	5·8
Suffolk ...	40	34	43	45	3·9
Worcester ...	39	45	42	51	4·2
Cheshire ...	38	39	41	48	5·2
Bedford ...	38	—	42	—	3·8
Counties with lowest infant mortality.					
Oxford ...	31	31	30	34	3·7
Hereford ...	31	—	33	—	4·9
Surrey... ...	32	32	31	41	3·5
Kent	32	39	32	29	3·7
Berks	32	28	34	30	4·3
Middlesex ...	33	—	35	—	3·2
Hertford ...	33	—	31	—	3·6
Devon	34	42	32	39	4·5
Warwick ...	34	43	35	53	4·1
Gloucester ...	35	42	32	36	4·1

with a maximum, medium, and minimum death-rate under one month of age. The death-rates under 1 month and for developmental and wasting diseases are given for county boroughs, if any, in the same counties. In the last column are set out the death-rates in the corresponding registration counties from puerperal sepsis and accidents of child-birth. It will be seen that most commonly the highest puerperal mortality occurred in the counties having the highest infant death-rates under one month, and that the medium and minimum death-rates under the two headings similarly corresponded. Thus in the first group eight counties, in the second group five counties, and in the third group two counties had a death-rate from puerperal sepsis and accidents of child-birth which was 4·5 per 1,000 births or higher.

One cannot dogmatise on the present imperfect information as to the extent to which the high maternal death-rates shown in the preceding table are caused by less competent care in and after parturition, and to what extent equal care produces less favourable results owing to the extremely unsatisfactory conditions of housing and domestic sanitation prevailing in the counties showing the highest maternal death-rates. The figures indicate, however, the importance of the investigation which the Board have already decided to make into the incidence of puerperal mortality in the counties of England and Wales. In this connection the remarks quoted on page 92 from Dr. Clayton's annual report for Gateshead, showing the excess of still-births among patients attended by midwives, and the remarks as to the preventible infantile illness due to untrained midwives, quoted on page 86 from Dr. Morris' annual report for Neath, Glamorganshire, should be read.

Meanwhile there is much *primâ facie* evidence pointing to negligent and careless attendance in child-birth and to consequent excessive mortality not only of mothers, but also of infants in early infancy. The fact that the death-rate from puerperal sepsis and accidents of child-birth for England and Wales as a whole has shown marked decline in recent years increases the significance of the extremes of county mortality from this source shewn in the preceding table.

The Age of the Mother.

Excessive infant mortality is often ascribable in part to too early motherhood with its associated inexperience and possible carelessness. The ages of both husband and wife have bearing on the life prospects of the offspring, in so far as ability to provide and maintain a suitable home is concerned. Körösi showed many years ago that the youngest mothers had the greatest number of weakly children. Larger children are produced by mothers of a mature age. Hence it is important to note that the number of minors to 100 marriages has declined among husbands from 8 in 1876-80 to 4 in 1908, and has declined among wives from 22 in 1876-80 to 14 in 1908.

In the following table the total infant death-rates, and the death-rates under one month, and from developmental and wast-

ing diseases in 1908 are compared with the average percentage of marriages of wives who were minors in 1898-1907 in the ten counties having the highest, medium and lowest total death-rates respectively.*

	Counties in order of magnitude of total infant mortality.	Infant death-rates in 1908 per 1,000 births.			Wives—proportion of minors in 100 marriages, 1898–1907.
		Total under one year.	Under one month.	From developmental and wasting diseases.	
Counties with highest total infant mortality.	Glamorgan	154	46	46	19†
	Durham	151	52	57	23
	Northumberland	147	53	55	18
	Monmouth	140	40	41	21
	Carmarthen	140	47	43	11†
	Stafford	132	47	51	19
	Yorks, W.R.	132	44	44	18
	Lancashire	131	43	44	15
	Denbigh	127	46	45	9†
	Cumberland	127	45	44	14
Counties with medium total infant mortality.	Lincolnshire	106	40	45	17
	Yorks, E.R.	106	42	43	19
	Cornwall	103	41	38	12
	Norfolk	103	43	45	15
	Cambridge	103	43	44	14
	Warwick	102	34	35	17
	Shropshire	100	40	40	10
	Worcester	99	39	42	14
	Middlesex	95	33	35	14
	Northampton	94	42	40	15
Counties with lowest total infant mortality.	Oxford	73	31	30	10
	Hereford	76	31	33	9
	Berkshire	77	32	34	11
	Dorset	78	35	32	12
	Wiltshire	78	37	27	12
	Hertford	79	33	31	12
	Buckingham	79	37	32	13
	Surrey	79	32	31	11
	Sussex...	80	36	36	12
	Gloucester	80	35	32	12

† In 1905. Average for entire period not given in Registrar-General's Report.

All the counties with a high proportion of wives under age have a high infant death-rate. At the other end of the scale all the counties having a low proportion of wives under age have low rates of infant mortality, with the exception of Denbigh and Carmarthen. Early marriages thus commonly are associated with excessive infant mortality. The two are probably connected in a manner which is remediable by education. A large

* The marriage statistics relate to registration counties, the other statistics to administrative counties.

part of the connection between them is probably less direct than at first sight appears; the real connection being that in busy industrial centres—in which the chief causes of high infant mortality especially prevail—marriage is practicable at an exceptionally low age. Most of the counties in which older marriages occur are chiefly rural in character. Reference to Table II. in Appendix III. will show that, taking the administrative counties in the order given in the table on the preceding page the percentage of the total births occurring in urban districts was 74, 55, 72, 88, 39, 81, 76, 88, 28, and 67 respectively in the ten counties with the highest infant death-rates; in the counties with medium death-rates, it was 43, 37, 43, 19, 41, 61, 46, 57, 96, and 54; and 33, 36, 29, 55, 44, 63, 37, 66, 51, and 31 respectively in the ten counties with the lowest total infant death-rates.

Poverty and Social Condition.

It is unnecessary to labour the point that infant mortality is highest among the poor and lowest among the well-to-do. The comparative statistics of the wards of any large town, or of the divisions of any scattered district prove this.* This is the more instructive, in view of the facts that probably 80 per cent. of the mothers of infants in wage-earning populations suckle their infants partially or entirely†, and the proportion of mothers in

* The following facts given by Dr. Meredith Richards in his annual report for Croydon, 1908, illustrate this :—

"It is impossible to define social status very accurately, but for some time past it has been our custom to divide the births in the borough into two groups, namely, those occurring in large houses and those occurring in small houses. Generally speaking, every tenement of six rooms and over is considered a large house. Adopting this more or less artificial grouping it is found that during 1908 there were 1,113 births in large houses, and of these only 49 died, a rate of 44 per 1,000 as compared with 2,884 with 349 deaths in smaller houses, a rate of 121 per 1,000. The low rate of 44 per 1,000 recorded in the larger houses is an interesting corroboration of the view that, with adequate care and sufficiently good environment, an infantile mortality rate of 50 per 1,000 is not an impracticable ideal."

† This is illustrated by the following figures :—

—	Number of Infants on whom Observations based.	Percentage of Infants.		
		Breast Fed.	Breast Fed and other Food.	Hand Fed.
Derby (Dr. Howarth) ...	8,343	63·2	17·3	19·5
Brighton	1,259	62·3	15·3	22·4

In the Brighton experience (working-class children only), the proportions were as follows in each three months of the first year :—

—	0–3.	3–6.	6–9.	9–12.
Breast fed	84·4	66·8	57·2	35·7
Breast fed and other food	6·9	11·6	17·0	28·7
Hand fed	8·7	21·6	25·8	35·6

the well-to-do classes who are able or willing to continue to give their infants this immensely important start in life is believed, I think rightly, to be much smaller. There must be reasons of great potency, enabling the infants of the well-to-do to survive in much higher proportion to the end of the first year of life, notwithstanging this heavy handicap against them.* (*See also* p. 71.)

Some light is thrown on the relation between social position and magnitude of infant mortality by the following facts as to number of domestic servants; this number may be taken as a rough index of social condition. It has to be remembered, however, that the proportion of domestic servants has not the same exact significance in rural as in urban counties.

The ten counties having the highest, lowest, and medium infant death-rates, at the last census had the following number of domestic servants per 1,000 females aged 10 years and upwards in each administrative county, the counties being stated in the order given in the first column of the table on page 53.

Proportion of Domestic Servants in each County.

Counties of highest infant mortality.	77	67	92	78	108	76	65	74	121	99
Counties of medium infant mortality.	117	142	95	113	124	114	136	108	134	96
Counties of lowest infant mortality.	125	141	160	123	108	135	111	187	173	123

Here again Carmarthen and Denbigh form exceptions to the rule. Excepting these two, all the counties having the relative social position indicated by the fact that more than 10 per cent. of the females over 10 years of age in the county were engaged in domestic service, had a medium or low infant mortality, while all the counties in which there were fewer domestic servants than 10 per 100 of the females over 10 years of age in the county had a high infant mortality.

The difference is not solely one between poverty and ease of circumstances *per se*. If it were so, the infant death-rate in Ireland and still more so in Norway should be much higher than in England and Wales. It was 138 per 1,000 births in England and Wales in 1901-5, and 118 in 1907, as compared with 81 and 67 in Norway, and with 98 and 92 in Ireland. (On Ireland see also pp. 49 and 60.) The difference in the main is due to certain removable evils, which are commonly associated with poverty in this country, and from which the well-to-do in a large measure escape. Poverty is a

* This point is put by Dr. Garrett in his annual report for Cheltenham for 1908 in the following words :—

"Though infants in good houses are more generally reared on artificial food than in poor houses, yet they die with much less frequency than in poor houses." He adds : "In better class houses artificial feeding is carried out with the greatest care and cleanliness, the meals are in proper quantity and at exact intervals, and it is at least one person's work to look after the baby. Under such careful treatment the child flourishes as well, and often better, than when breast fed. In the poor houses what kills the children is the carelessness, the non-avoidance of dirt and disease germs, the irregularity, the impropriety and the insufficiency of the diet."

complex condition, including a number of elements, and we are concerned at present in determining what elements of poverty are most potent in producing excessive infant mortality. The difference is not one of large as distinguished from small families, though this is suggested by the fact that the average family is smaller among the well-to-do than among the poor. The populations of Norway and Ireland have much larger families than the English population. In 1901 the corrected birth-rate of England and Wales was 28·4, of Norway 37·8, and of Ireland 36·1 per 1,000 of population.*

The conditions determining excessive infant mortality among the poor have some of them been already considered. Among these illegitimacy with consequent neglect of infants is a minor cause. The unduly early marriage of wives in certain counties favours a high infant mortality under present conditions. Much more important than these, is the inefficient as well as insufficient care received by a large proportion of parturient women of the wage-earning classes during child-birth, and the ignorant and often mischievous guidance in infantile hygiene which they receive from incompetent midwives and still more from monthly nurses. To this must be added the frequently insufficient nursing both of mother and infant during the period of weakness and greatest danger following birth.

Of the remaining causes of excessive infant mortality among the poor, the next to be considered is,—

The Non-domestic Employment of Married Women.

Dr. Reid during a series of years has published a table showing the infant mortality rates in different groups of artisan towns in the administrative county of Stafford, classified according to the proportion of married women workers in each.

In the following table† he has classified the results of 28 years:—

Class according to percentage of Married and Widowed Workers to Female Population between 18 and 50 years.	No. of Towns.	Total Population, 1901 Census.	Deaths of Infants under 1 year per 1,000 registered births.		
			1881–1890.	1891–1900.	1901–1908.
I.—12 per cent. and over	5	132,299	195	212	187
II.—Under 12 per cent. and over 6 per cent.	13	263,868	165	175	153
III.—Under 6 per cent.	8	131,508	156	168	140

† Annual Report, Staffordshire, 1908.

The infant death-rate is greatest and has declined least in the five larger towns having the highest proportion of married and widowed women industrially employed. Such statistics are unavoidably open to the objection that

* See table on pp. 40–51 of "The Decline of Human Fertility, &c.," by A. Newsholme and T. H. C. Stevenson (*Jour. Roy. Statist. Soc.*, Vol. lxix., Part. I., 1906).

other social and sanitary circumstances possibly may not be approximately equal in the compared groups. That is a difficulty inherent to most statistical investigations in which only two variants are considered at one time; and the same difficulty arises in connection with any one of the preceding paragraphs in Part III. of this report separately considered.

Dr. Robertson has recently published* an account of a careful investigation into the health of the 1,503 infants of 1,212 mothers in two wards of Birmingham, of whom 611 were, and 601 were not, industrially employed during pregnancy,† the infant death-rate in the former group being 190 and in the latter group 207 per 1,000 births. The selected populations were obviously small,—also very poor; and in Dr. Robertson's opinion great poverty had more influence in increasing infant mortality than industrial employment. It may be accepted that under circumstances of extreme poverty the money earned by the mother, who has to leave her infant for this purpose, may have greater influence in reducing infant mortality than the same mother would be able to exercise under the circumstances of still deeper poverty which her stay at home would have meant. It will be agreed by all, however, that the industrial employment of mothers under such circumstances is a serious evil.

The problem of industrial employment of women can be studied on a wide scale by means of the census data for 1901. In the following table the number of married and widowed women per 1,000 total females aged 10 years and upwards is stated, the rates being given in the same order and relating to the same counties as are enumerated in the table on page 53.

Number of Married and Widowed Women engaged in Occupations per 1,000 *Females aged* 10 *years and upwards.*

In counties of highest infant mortality.	31	26	31	38	54	65	57	85	48	47
In counties of medium infant mortality.	51	53	48	54	65	68	55	78	57	67
In counties of lowest infant mortality.	68	67	70	60	54	55	63	57	58	75

At the time of the last census the proportion of occupied married and widowed women was more than 5 per cent. in 4 out of the 10 counties having the highest infant mortality, was more than 5 per cent. in 9 out of the 10 counties having medium infant mortality, and was more than 5 per cent. in all of the 10 counties having the lowest infant mortality. It would be folly to infer from this that the industrial occupation of mothers is not a most injurious element in our social life. It may be, however, that under present conditions, as apparently in the Birmingham experience mentioned above, the gain in diminution of poverty overbalances the serious injury due to the absence

* Report on Industrial Employment of Married Women and Infantile Mortality, Birmingham.

† 164 of the industrially employed mothers were primiparæ, only 55 of the mothers not industrially employed were primiparæ.

of the mother at work, during pregnancy and after the birth of her infant. There must, however, be other means of securing a living family wage without sacrificing the health of the infant. It has to be noted, furthermore, that in none of the counties in which the largest proportion of married and widowed women are employed does the proportion thus employed mount up to 10 per cent. of all females over 10 years of age; and the evil effect of such industrial employment might easily be statistically lost among the other and still more potent injurious influences affecting all mothers and their infants, whether the mothers are industrially employed or not. The most that can be inferred from the above figures is that the industrial employment of married and widowed women cannot be regarded as, in itself, the chief cause of excessive infant mortality. Thus Glamorgan and Northumberland (31 each), Durham (26), and Monmouth (38) have the lowest proportion of industrially employed married and widowed women of all the thirty counties under consideration. They also have the highest infant mortality. Lancashire (85), Staffordshire (65), and the West Riding of York (57), have high proportions of occupied wives and widows, with a high infant death-rate; Gloucester (75), Berks (70), Oxford (68), and Hereford (67), have high proportions of occupied wives and widows, with a low infant mortality. The figures for administrative counties given in past census reports are not sufficiently delicate for this investigation. Thus it is likely that the absences from home are less protracted in the last named counties, than in the counties of the textile and pottery industries. The statistics derivable from the next census enumeration will doubtless throw much light on this problem, as it will be possible to state separately infant mortality among the children of women employed gainfully at home and away from home.

The predominant industrial occupations of males in the different administrative counties have an important bearing on the same problem.

The main facts are set out in the following table, for the sixteen counties having the highest, and for the twelve counties having the lowest infant mortality in 1908. It will be noted that here, as in most other parts of this report, administrative counties are dealt with. The conditions in county boroughs have been left for consideration in a later report.

This table shows that the lowest infant mortality occurs in the counties in which agriculture is the chief industry. Carmarthen is an exception, having more than one-fifth of its total male population over ten years of age engaged in agriculture. One eighth of its male population over ten is engaged in mining, and nearly one eighth in metal working of various kinds. The North Riding of Yorkshire is a second exception, but here again a large proportion of the population is engaged in metallic works and in mining. Examination of the local statistics in these counties shows that the excessive infant mortality occurs chiefly in their non-agricultural parts. A study of the lower part of the following table confirms the conclusion derivable from its upper part that infant mortality is most excessive in the counties

in which there is least agriculture. The industry which is associated with the highest infant mortality is mining; next come the industries of the pottery districts; and then the textile industries of Lancashire and Yorkshire. The heaviest infant mortality occurs in those counties in which a high proportion of the population is engaged in the various forms of metallic working as well as in mining.

Census 1901.—*Proportion per* 10,000 *males aged* 10 *years and upwards, in certain groups of occupations.*

	Administrative County of	Agriculture.	Coal and other Mine Workers.	Textile Workers.	Workers in Metals, Machines, Implements and Conveyances.
Counties with Highest Infant Mortality.	Glamorgan	351	4,409	8	856
	Durham	348	3,119	14	1,495
	Northumberland	895	2,513	13	1,272
	Monmouth	802	3,823	5	1,003
	Carmarthen	2,175	1,356	161	1,243
	Stafford	649	1,408	79	1,853
	Yorks, West Riding ...	733	1,795	1,186	921
	Lancashire	599	1,119	1,623	773
	Denbigh	1,846	2,068	28	371
	Cumberland	1,541	1,356	93	890
	Carnarvon	1,568	2,506	24	278
	Derby	871	2,582	498	856
	Nottingham	1,489	2,059	435	576
	Yorks, North Riding ...	2,225	656	26	1,080
	Cheshire	1,211	187	697	924
	Leicester	1,604	1,180	543	563
Counties with Lowest Infant Mortality.	Oxford	2,999	44	93	391
	Hereford	3,458	39	6	299
	Berkshire	2,076	6	9	331
	Dorset	2,141	160	84	347
	Wiltshire	2,301	122	105	1,024
	Hertford	1,707	35	15	351
	Buckingham	2,142	11	5	650
	Surrey	995	32	11	274
	Sussex, East	1,925	35	15	242
	Sussex, West	2,460	33	7	271
	Gloucester	1,897	684	124	423
	Somerset	2,225	460	151	352
	Hampshire	1,667	13	5	388

As already seen, the industrial employment of women cannot explain the excessive infant mortality in the mining counties. It must be regarded as an auxiliary cause of excessive infant mortality in the textile counties, for it cannot be conceived that the absence of mothers from home for a large part of each day can be free from danger to their infants, besides being injurious to their older children, who are deprived of maternal care and are insufficiently or improperly fed as the result of the

mother's absence. For statements of the evils of industrial occupation of married women, the extracts given in Appendix II. should be read at this point. Attention is particularly drawn to the remarks of the medical officers of health of Ardsley (page 105), of Batley (page 106), of Clitheroe (page 108), of Burnley (page 108), of Tunstall (page 102), and of Macclesfield (pp. 113 and 114).

As already seen, when the statistics of large communities are considered, the evil effect of the industrial occupation of women is concealed by the preponderant action of other maleficent influences. These may be classified, not without overlapping, under one or other of the following heads:—

1. Crowding of persons on area.
2. Defects of domestic and municipal sanitation.
3. Domestic overcrowding and allied evils of housing.
4. Ignorance and fecklessness of mothers resulting in "lack of mothering."

In the communities having excessive infant mortality, the first three of these, either all together or one or more of them, affect either the entire population or a large portion of it. Industrial occupation of married women affects in most instances a smaller section of the maternal population and their infants.

Crowding of Persons on Area.

Ireland has already been given as an instance of a country which, with a population on the average relatively poorer, has a lower infant death-rate than England. This lower infant death-rate is associated to a preponderant extent with rural conditions of life. Further examination of the facts brings out their full significance. If the two chief cities of Ireland—Dublin and Belfast—are compared with other great cities in the United Kingdom, the superiority of the Irish experience disappears. This is shown for the four years 1906-09 in the following table:—

Infant Death-rates per 1,000 *Births in certain Great Towns,* 1906–09.

Year.	Dublin City.	Belfast County Borough.	London.	Liverpool.	Edinburgh.	Glasgow.
1906 ...	150	144	131	172	118	131
1907 ...	159	136	116	144	127	130
1908 ...	145	147	113	141	122	137
1909 ...	145	139	108	144	119	133

City life is more destructive to infants in Dublin, Belfast, and in Liverpool than in Glasgow, and much more destructive than in London or in Edinburgh.

A similar lesson is brought out by the following figures obtained from the annual report of the Registrar-General for Ireland:—

Ireland, 1908.—*Infant Mortality per* 1,000 *births in the total Civic Unions and in the remaining parts of Ireland at different portions of the first year of life.*

——	Under 3 months.	3–6 months.	6–12 months.	Under 1 year.
In the total Civic Unions having in 1901 a population of 10,000 and upwards.	68·8	25·9	34·8	129·5
In the rest of Ireland	47·7	11·6	15·8	75·1
Percentage Excess of infant mortality in Urban parts of Ireland.	44%	124%	120%	72%

The civic unions represent chiefly the urban, and the rest of Ireland the rural portions of the population of the country. Clearly then Ireland may be said to owe its low infant mortality in large measure to the sparseness of its population.

Lest this example should appear to permit the inference that there is a *necessary* association between crowding of persons on area and a high infant mortality, the corrective experience of the Peabody Buildings is given here.

At the end of 1909 the Governors of the Peabody Donation Fund had provided 13,418 rooms in London, comprised in 5,687 separate dwellings, of which 300 were cottages, the rest being in block buildings. The mean population in 1909 was 20,147, showing a density of 504 persons to the acre, nearly eight times that of London.

The average weekly earnings of the head of each family living in these tenements was 21*s.* 10*d.* The average weekly charge for each dwelling, including the weekly proportion of rates, was 5*s.* 4*d.* During the five years 1905–09 the birth-rate in the Peabody Buildings averaged 30·3 per 1,000 of population, and the infant mortality 92·2 per 1,000 births, the birth rate in the same period for the whole of London being 25·7 per 1,000 of the population and the infant mortality 120 per 1,000 births. In the same period the infant mortality in Kensington was 126, and in Hampstead was 76 per 1,000 births.

These two extreme instances are instructive when applied to the experience of the administrative counties of England and Wales. It has been shown that in counties in which coal mining, textile industries, and metallic working predominate, infant mortality is excessive. To what causes is this excessive mortality due? The wages of men in these occupations are higher than agricultural wages, and the general standard of comfort is higher among wage-earners in industrial districts than among agricultural labourers, whose infants prosper by comparison. Poverty then is not the predominant cause of the excessive mortality in these counties, though its presence is a serious handicap for the infant.

All the available evidence points to the conclusion that it is certain elements of urban life which cause excessive infant mortality.

In 1909, the infant death-rate was 118 per 1,000 births in the 76 great towns, 111 in the 143 smaller towns, and 98 in England and Wales *minus* the 219 towns.

That the excessive infant mortality is not a *necessary* occurrence in towns has been shown above, and may be similarly shown by the experience of 1909. Among the 76 great towns the infant death-rate was only 79 in Hastings, 80 in Croydon, 92 in Ipswich, 95 in Huddersfield, and 97 in Halifax, while it was 138 in Wolverhampton, 139 in Walsall, 141 in Salford, 143 in Merthyr Tydfil, 144 in Liverpool, 150 in St. Helens and in Nottingham, 156 in Burnley, 155 in Hanley, 159 in Swansea, and 173 in Wigan.

Among the 143 smaller towns the infant death-rate was 55 in Guildford, 64 in Tunbridge Wells, 70 in Ilford, 72 in Peterborough, 82 in Lincoln; and as high as 180 in Burslem, 182 in Hindley, 188 in Ilkeston, 204 in Tunstall, and 212 in Ince-in-Makerfield.*

The population of the rural districts of the county of Durham is as a rule compactly massed in large villages having some of the worst characteristics of urban districts, and an associated high infant mortality.

Doubtless some of the above towns have rural or semi-rural portions within their area, and others are residential districts; but such contrasts as Huddersfield and Swansea, Lincoln and Tunstall or Ince-in-Makerfield, cannot be thus completely explained.

And yet in the Peabody Buildings an extremely dense aggregation of population on area is associated with an infant mortality much lower than that in houses occupied by persons of a similar class in the same metropolitan boroughs. The explanation of this anomaly brings us to the consideration of the three last mentioned conditions favouring infant mortality; defects of domestic and municipal sanitation, domestic overcrowding, and ignorance or carelessness of mothers.

The following remarks written in 1891 may be quoted as giving the clue to the anomalous experience just quoted:—

> The number of rooms occupied by each family is of much greater importance in relation to health than the number of persons living on a given area, as this fact throws important light on the state of each tenement as regards overcrowding. In the Peabody Buildings the average number of persons to each room is 1·8. Given houses properly constructed and drained, and given cleanly habits on the part of the tenants, increased aggregation of population on a given area has no influence in raising the death-rate, except in so far as it is accompanied by *overcrowding in individual rooms*, an event which is by no means necessary under the circumstances named. In other words, there is no causal relationship between density of population *per se* and a high mortality. *The true index of density is the number of persons to each occupied room.*

The population of Peabody Buildings live under strictly regulated conditions, each family being kept up to a certain standard of cleanliness; there is no overcrowding in rooms; and the general sanitation of the Buildings is satisfactory. When these conditions are not completely fulfilled dense aggregation of dwellings on area is beset with dangers. The disposal of excretal

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* Annual Summary of Registrar-General, 1909.

matter, of house refuse, of dirty water, if neglected or postponed, involves constant danger to health, and especially to the health of children; and unfortunately local sanitary government in a large proportion of industrial areas, especially of the smaller areas, has proved itself only partially equal to the task of rendering urban aggregation safe by controlling overcrowding and gross sanitary defects. The evidence of this is overwhelming. The extracts given in Appendix II. could be multiplied manifold by further extracts from reports of medical inspectors of the Board and from reports of medical officers of health. They show the association of defective sanitation and excessive infant mortality.

Defective Sanitation.

The defects of sanitation which are specially associated with excessive infant mortality come under one of three heads. Commonly all three occur in the same districts.

(1.) Conservancy methods of disposal of excreta.

(2.) Inefficient scavenging of domestic refuse, and still worse inefficient scavenging when the contents of pail-closets and privies have to be emptied.

(3.) Unpaved or unmade-up roads and back streets, and unpaved back yards of dwellings.

All these lead to dirtiness of the environment of the house, to treading of dirt, often of excretal origin, into the house, to a lowering of domestic cleanliness, and—what is perhaps worse—to the disheartening of the overworked mother, who wearies in her house-pride, which is constantly being thwarted by the terrible condition of things outside the back door.

A large part of the densely populated parts of the counties of Durham and Glamorgan and certain parts of Lancashire, Staffordshire, and Yorkshire, are in a profoundly lower condition as regards elementary sanitation than other parts of England.

The extracts given in Appendix II. give striking illustrations of the fact that this insanitary barbarism continues in certain districts in the face of faithful advice and warning from medical officers of health, who, by giving this advice, may incur the risk of not being re-appointed when their limited term of office ends. In other districts amelioration is in progress; sometimes with a slowness which appears to imply that pockets are to be considered more than lives. The extracts from the reports on Rhondda (page 85) and on Merthyr Tydfil (page 86), and Dr. Wheaton's report to the Board on another Glamorganshire district (Maesteg, page 87) give illustrations of one or other of the three groups of sanitary defects.

Dr. Wheaton has also recently reported on the excessive prevalence of enteric fever in the county of Durham.* Excessive

* New Series, No. 35.

infant mortality commonly implies also excessive enteric fever. He states:—

In the County of Durham privies are almost universal. The midden privy is the form usually in use, but of late years a number of midden privies have been replaced by ash privies, usually styled "ash closets."

Many of the midden privies are very large with uncovered receptacles sunk below the ground level, not watertight, and serving for two, four, or a much larger number of houses. In some districts many of these privies are greatly dilapidated and without proper doors, so that their contents escape on the surface of the streets, or back streets, in which they are situated. The ash privy is an improvement upon the midden privy. It is from 8 to 20 cubic feet in capacity, entirely above the ground level, covered in, and its bottom is cemented. Ashes are thrown in from the front, so that the excrement is covered up, the contents being withdrawn through a door at the back. Unfortunately, in many instances the sill at the bottom of the door is on the floor level, so that liquid contents escape beneath the door into the street, or back street, especially if the privy become at all full. Nuisance from this cause is much aggravated by people in many districts throwing slop water in these privies, which, so long as these privies continue in use, can only be prevented by active co-operation between householders and sanitary authorities. In some districts, also, people neglect to place ashes in the privy, when similar nuisance arises. Of late, in newly constructed ash privies, the sill of the door in many districts has been raised so as to retain liquid material, but this, of course, renders the cleansing more difficult and not so complete. The contents of midden privies have to be thrown out on the ground in many districts, from which they are shovelled into a cart or basket. In many instances the contents have to be conveyed through the dwellings in baskets, to be emptied into the cart in the street. Under these circumstances the ground of the streets and back streets and in many instances also the interiors of the dwellings become fouled with excremental filth.

Dr. Johnstone's remarks* on the method of excremental disposal in Easington rural district in the County of Durham and on the condition of its roads and back streets (pp. 92-93) may be compared with Dr. Wheaton's more general description. Dr. Eustace Hill, the county medical officer of health, ascribes the lower infant mortality in the boroughs within the county of Durham to their better paving of streets, and back yards, to their better scavenging, and generally to their more adequate sanitary supervision than is found in the rest of the county (page 90). On this point the remarks of Dr. Horne as to Stockton-on-Tees should be read (page 92).

As bearing on the condition of things in Northumberland Dr. Hembrough's remarks on Berwick-on-Tweed (page 96) and on Newbiggin-by-the-Sea (pp. 97-98) should be consulted; also Dr. Trotter's comments on the deplorable condition of roads in colliery villages in Bedlingtonshire (page 97).

The evils described in the annual report of the medical officer of health of Gorton (recently added to the City of Manchester) confirm the need for local government on a scale which will enable more efficient sanitary control to be exercised (page 109). Dr. Sergeant's summary given on page 107 shows that in 88 urban districts of the administrative county of Lancashire privy middens and pail closets still form two-fifths of the total sanitary conveniences in these districts.

In the West Riding of Yorkshire a similar story has to be told of many districts. See Dr. Hillman's remarks on Whitwood (page 105) and the remarks of Dr. Clements on Batley (page 106).

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* New Series, No. 20.

Dr. Kaye in his annual report for the West Riding (1908) makes the following remark on the importance of the method of excrement disposal, as an index of the general sanitary status of a district:—

> The type of closet generally in use in a district may be taken to indicate roughly the stage reached in sanitary civilisation. Where the up-to-date water closet is general, it usually means that the district is possessed of a proper water supply, sewerage scheme, and sewage disposal works, and it may also be assumed that the disposal of dry refuse is managed on modern lines.

In Staffordshire the experience of Tunstall illustrates the circumstance that a district which has nearly abolished the privy system may still suffer severely from diarrhœa, etc., the closets being only hand-flushed and therefore in a very foul condition (page 102). Aberdare in Glamorgan furnishes another example of this (page 88). Dr. Reid's comments on the horribly insanitary arrangements at Darlaston are given on page 103.

The evils of insanitary backyards are brought out by Dr. Marsh, medical officer of health of Macclesfield (page 115). Dr. Corbin's remarks on Stockport (page 116) should also be read.

What is the evidence associating the conditions of which illustrations have been given above with excessive infant mortality? It can be classified under two heads. First the heaviest infant mortality, and in particular, the heaviest infant mortality from diarrhœa occurs in the districts in which the three forms of sanitary defects enumerated above are rife; and secondly, districts from which these evils are removed experience a lowering of infant mortality which is greater than that of other districts in which these evils continue.

Causation of Diarrhœa.—The first statement is proved by the diarrhœal death-rates given on page 33, which show that the highest death-rates occur where sanitation is least advanced, and especially where conservancy methods of disposal of excrement are known to prevail.

The same lesson emerges, though less distinctly, from the statistics for 1909 given in the Annual Summary of the Registrar-General.

1909.—*Death-rates from Diarrhœa per* 100,000 *of Population.*

A. *Lowest and Highest Rates in the* 76 *Great Towns.*

Lowest.		Highest.	
King's Norton ...	7	Rhondda	97
Hornsey	8	Swansea	84
Hastings	10	Middlesbrough ...	83
West Hartlepool ...	11	Bootle	78
Croydon	12	Walsall	76
Halifax	12	Liverpool	70
Rochdale	13	Nottingham ...	69
Barrow-in-Furness	14	Wigan	69

B. *Lowest and Highest Rates in the* 143 *Smaller Towns.*

Lowest.		Highest.	
Winchester ...	—	Mansfield	72
Southport	—	Barking Town ...	72
King's Lynn ...	—	Ilkeston	76
Stalybridge ...	—	Bilston	97
Brighouse ...	—	Barnsley	102
Shipley	—	Leigh	102
Carlisle	2	Longton	104
Todmorden ...	4	Ince-in-Makerfield	182

As it is the excess of epidemic diarrhœa which largely determines excessive infant mortality, I may be permitted to give the main conclusions which I stated in 1899,* as the result of an analysis of epidemic diarrhœa in the 28 great towns in England.

1. Epidemic diarrhœa is chiefly a disease of urban life.
2. Epidemic diarrhœa as a fatal disease is a disease of the artizan and still more of the lower labouring classes to a preponderant extent.
3. Towns which have adopted the water carriage system of sewerage, have as a rule, much less diarrhœa than those retaining other methods of removal of excrement.
4. Towns with the most perfect scavenging arrangements have the least epidemic diarrhœa.
5. Given two towns equally placed so far as social and sanitary conditions are concerned, their relative diarrhœal mortality is proportional to the height of the temperature and the deficiency of rainfall of each town, particularly the temperature and rainfall of the third quarter of the year.

It is with the third and fourth conclusions that we are now chiefly concerned. The facts in this report illustrate their truth, and the comparative experience of Leicester and Nottingham which was detailed in my annual report to the Board for 1908-09,† gives a further striking illustration of the decline in diarrhœal mortality which can be secured by improved sanitation. In Nottingham pail closets still serve more than half the houses; Leicester has abandoned this system entirely, substituting water-closets. Other conditions in these two towns are fairly similar. The course of diarrhœal mortality in the two towns is illustrated by the following proportional figures:—

Proportional Mortality from Diarrhœa and Enteritis.‡

—	1889–93.	1894–98.	1899–1903.	1904–08.	1909.
Nottingham	100	139	145	119	96
Leicester	100	115	89	78	48

In the interval between the first and last period the diarrhœal death-rate in Nottingham only declined 4 per cent.: in Leicester it has declined 52 per cent.

It is an accepted fact that defective scavenging and the retention of excremental matters in privies and pail closets are always accompanied by excessive infantile diarrhœa. For our present purpose it is unnecessary to argue the exact method

* *Public Health:* December 1899. † Page xxv.

‡ Based on the death-rate from diarrhœa and enteritis per 1000 births. The average death-rate in 1889–93 in Nottingham was 37·9, in Leicester 52·3. In 1909 it was 36·2 in Nottingham and 24·9 in Leicester.

of convection of infective material. Although flies doubtless carry it to food, there must also be contamination by dust and by the direct soiling of hands and clothes. It must not be assumed, however, that diarrhœa is a complete index of excessive infant mortality due to excremental pollution. The fact that the poor, on whom the conditions of life press heavily, have to bear "the additional daily burden of close company with a stinking mass of putrefying filth, the periodical emptyings of which spread the savour broadcast and poison the surface of the ground for yards around,"* implies further evil results. These are not so easy to measure as the excess of diarrhœal deaths; though their presence can be detected. The counties in which privies prevail under urban conditions are the black patches of the country in respect of enteric fever. This disease may attack infants as well as adults. The excessive death-rate from "Convulsions" in these counties to some extent implies poisoning of the digestive organs. It is significant also that infantile bronchitis and pneumonia are twice as fatal in the industrial counties as in the rural counties. Nor can the excessive death-rate during the first month of life in the same counties be dissociated from the likelihood that at this most sensitive age the poisoned environment supplied by the effluvia of privies and of overcrowded houses (see also under *Domestic Overcrowding*) is largely concerned with the greater death-toll.

In the preceding sentences discussion has been concerned with the excess of infant mortality and especially of infantile diarrhœa in the industrial communities in which conservancy systems and especially privy middens prevail. Two points have to be borne in mind, in order that the subject may be kept in due perspective.

1st. Privies in hamlets and villages are not associated with the same excess of diarrhœa as in densely populated urban districts.

2nd. The infants in towns in which every house is supplied with a fairly efficient water-closet suffer still from diarrhœa, though to a much less extent.

On the first point it is only necessary to remark that in villages which are not compact the possible evils of conservancy methods of excremental disposal can usually be entirely obviated by careful management; and on the second point it is important to remember that in hot weather the infecting material of diarrhœa is widely scattered and only rigid cleanliness can keep it out of infants' food. With a conservancy system of domestic sanitation under town conditions this appears to be almost impracticable, the possibilities of massive infection being so numerous; with a water-closet system one of the chief dangers has disappeared, but infective material may be supplied from the dustbin or ashpit if not properly kept and emptied, from neighbouring manure-heaps, from the dust blown or trodden in from imperfectly scavenged streets, or actually brought into the house on children's hands or clothes, or by flies.

The responsibility for a large portion of the total infant mortality and of the mortality from infantile diarrhœa must be borne by sanitary authorities. Domestic cleanliness has not a fair

* Extract from Report of Dr. Marsh, Macclesfield (see page 115).

chance, so long as sanitary authorities permit the continuance in closely aggregated towns and in larger compact villages of privies and other arrangements for keeping excretal products near the house; so long as they do not carry out scavenging satisfactorily; and so long as they allow streets and yards requiring it to continue unpaved.

It is satisfactory that medical officers of health are not failing to emphasise the responsibility of their Authorities: see for instance the remarks on the County of Durham by Dr. E. Hill (pp. 89-90); of Dr. Taylor on Chester-le-Street, (page 91); of Dr. Horne on Stockton-on-Tees (page 92); of Dr. Marsh on Macclesfield (pp. 113-115); of Dr. Corbin on Stockport (pp.115-116); of Dr. Hembrough on Northumberland (page 96); of Dr. Trotter on Bedlingtonshire (page 97); of Dr. Reid on Staffordshire (pp. 101-102); of Dr. Partridge on Darlaston (pp. 102-103); of Dr. Hillman on Whitwood (page 105); of Dr. Clements on Batley (page 106); of Dr. Sergeant on Lancashire (page 107); of Dr. Martin on Gorton (page 109); of Dr. Jenkins on Rhondda (page 85); of Dr. Duncan on Merthyr Tydfil (page 86); and many others which might be quoted. The medical inspectors of this Board in a long series of reports have drawn repeated attention to these and allied sanitary defects.

Domestic Overcrowding.

Domestic overcrowding is concerned with the number of persons per occupied room, and as already stated (page 62) this is a much better test of injurious crowding than a statement of the number of persons living on a given area. Although nine years have elapsed since the last census the housing statistics given in the following table, which have been taken from the census reports, probably show fairly well the present relative position of the different counties. In the county of Durham overcrowding has probably increased since the last census results were published. The counties with highest and lowest infant mortalities are selected for comparison: —

Counties with highest Infant Mortality:	Proportion per 100 total dwellings which contained fewer than 5 rooms.	Proportion per 100 Persons in the total population who were living more than 2 in one room.
Glamorgan ...	33	4·9
Durham	76	28·5
Northumberland ...	78	32·1
Monmouth ...	46	7·0
Stafford	45	7·4
Yorks, W.R. ...	57	10·3
Lancashire ...	45	5·1
Cumberland ...	44	8·5
Carnarvon ...	37	4·8
Derby	40	4·8
Nottinghamshire...	30	2·5
Yorks, N.R. ...	38	5·1
Cheshire	39	3·6
Leicester	33	2·6

Counties with lowest Infant Mortality:	Proportion per 100 total dwellings which contained fewer than 5 rooms.	Proportion per 100 Persons in the total population who were living more than 2 in one room.
Hampshire ...	29	2·0
Somerset	32	2·7
Gloucester ...	39	4·0
Sussex, East ...	26	1·5
Sussex, West ...	22	1·1
Surrey	27	1·9
Buckingham ...	36	3·0
Hertford	34	2·9
Wiltshire ...	40	4·1
Dorset	33	2·4
Berkshire ...	35	2·9
Hereford	38	3·0
Oxford	43	4·8

Durham and Northumberland stand unenviably supreme in the inferiority of their housing accommodation and in the amount of their domestic overcrowding. Glamorgan which shares with them the highest infant mortality had better housing on the basis of the census data, when judged by the proportion of dwellings of less than 5 rooms and by the amount of overcrowding. This illustrates the importance of considering the facts as to excrement removal along with the facts as to housing. The mining towns and villages of Glamorgan are commonly situated in narrow steep valleys with closely aggregated houses clinging to the hill-side. These physical features must serve to intensify the evils of the privy system and of defective scavenging. In Durham, although a high proportion of its districts are technically rural, insanitary houses are closely aggregated in urban fashion in large villages.

The extracts given in Appendix II. illustrate the evil conditions of housing prevailing in the counties of high infant mortality, particularly in Durham and in Glamorgan.

Summary as to Defective Sanitation and Overcrowding.— The association between excessive infant mortality and sanitary defects including domestic overcrowding under urban conditions of life is too close to leave any doubt of the essential relation between them. The relation is demonstrable so far as infantile diarrhœa is concerned. That much of the excess under other causes of infant mortality has a similar origin is highly probable. It is also probable (see pages 39 and 67) that these environmental conditions have a considerable share in the production of that excessive mortality during the first month of life, which commonly occurs in the counties having excessive diarrhœal and excessive total infant mortality. It is not unreasonable to assume that the health of the expectant mother and of her offspring is injured by protracted exposure under conditions of stress and weakness to the effluvia of decomposing ordure and to the evils of domestic overcrowding.

No strict line can be drawn between municipal and parental responsibility for the uncleanliness which makes for loss of infant

life. The municipal aspect has already been dealt with to some extent. It is in the power of sanitary authorities to make domestic sanitation easy, instead of extremely difficult as it still is in a large number of districts, especially of the great industrial counties. The case of domestic overcrowding is more difficult.

In the case of the mining counties (see pages 87 and 93-95) the responsibility for inferior housing is divided between the sanitary authorities, the colliery owners, and the miners themselves. The latter receive relatively high wages, but content themselves with grossly inferior homes. Until they are willing to spend a considerably larger proportion of their weekly earnings in higher rentals, satisfactory progress will scarcely be made.

In this, as in other aspects of domestic sanitation, elevation of the standard of living is an indispensable condition of progress. More house-pride, and a greater willingness to spend less on ephemeral pleasures which do not increase domestic comfort, are urgently needed; and it may be hoped that the concentration of public opinion in this direction will effect the desired end, as it has already done much to reduce infant mortality in other directions.

As municipal merges into family duty, the two in a well-organised community being complementary to each other, we come finally to the domestic causes of excessive infant mortality.

Ignorance and Fecklessness of Mothers.

The mother is the natural guardian of her child, and no other influence can compare with hers in its value in safeguarding infant life. Happily it is beyond doubt that nearly every mother is profoundly wishful to secure the welfare of her offspring, and will welcome any aid judiciously offered in this direction. It is in the light of this general truth that the remarks made below and the extracts from reports of medical officers of health, given in Appendix II. should be interpreted.

The first condition of safe rearing of infants is breast-feeding.* Milk depôts for the supply of pasteurised milk for infants imply that the mother has failed to fulfil this need for her infant; and medical officers of health directing such depôts have, therefore, carefully safeguarded their use so that they shall not serve to encourage the abandonment of breast-feeding. For similar reasons, schools for mothers and infant clinics have been inaugurated by social workers, with a view to help the necessitous mother to fulfil this primary duty to her infant, if necessary by arranging for the provision of meals during late pregnancy and after child-birth.

Probably four-fifths of the babies of the wage-earning classes are breast-fed during the first nine months of infancy,† and a smaller proportion of infants of other classes. And yet the infant

* As illustrating this point may be quoted the fact that infants have been found to lose from 3 to 15 ounces in weight during the first few days after birth. Breast-fed infants begin to increase in weight again on the 3rd or 4th day after birth; those fed on cows' milk do not regain their original weight by the tenth day. (Winckel quoted by Buck.)

† *See* footnote, page 54.

mortality in the latter is relatively low. In 1874 Mr. C. Ansell* published an inquiry into the death-rate among 49,099 English children of the upper and professional classes. He found that 2 per cent. of these were still-born, and that the infant death-rate was 80·5 per 1,000 births. In the whole of England and Wales the infant dath-rate was 158 in 1875. It is still 109 in the year 1909.

The causes of this excess have already been considered so far as they are concerned with circumstances more or less outside the control of the mother herself. These circumstances go far towards explaining the continuing excess of infant mortality (a) among the wage-earning classes, and (b) still more in certain counties and towns.

The evils of environment set out in preceding sections fail, however, completely to explain the excess of infant mortality in certain districts. The further explanation consists in facts which are well-known.

They are set out with more or less fulness in the extracts from reports of medical officers of health given in Appendix II. They form the text of the warnings and instructions, verbal and written, now distributed to mothers in many sanitary districts; and they are the subject of the counsel now being given to an increasing extent by health visitors.

Among them may be mentioned first the dangerous custom among mothers of giving occasional "tastes" of their own food to the baby when still breast-fed.

Secondly comes the substitution of artificial for natural feeding. This is one of the chief evils associated with the industrial employment of women. Apart from such industrial employment, however, many mothers are persuaded by ignorant neighbours that the baby is "not satisfied," and that mother's milk needs supplementing by artificial food. One of the chief uses of health visitors is to counteract mischievous advice of this type.

Thirdly, when partial or entire artificial feeding cannot be avoided, the artificial food is prepared under uncleanly conditions, gastric disturbances and diarrhœa being produced.

Artificial feeding also carries with it the fact that the majority of infants thus fed are being slowly starved in respect of the essential fat in their food. Very few artificial foods—not even the cows' milk commonly employed in substitution for maternal milk—contain a sufficient proportion of fat to enable healthy growth to be made; and a weakly childhood associated with rickets commonly results if the infant survives.†

The majority of mothers are profoundly ignorant of the relative nutritive value and digestibility of different foods; and health visitors as well as doctors are needed to explain such points in detail, if the present unnecessary sacrifice of infant life and of efficiency in those who survive is to be avoided.

It is the ability to obtain skilled guidance in the preparation of infants' food, to spend sufficient money in purchasing it, and to

* Statistics of Families in Upper and Professional Classes, 1874.

† Dr. Coutts is at the present time engaged on behalf of the Board in an investigation on condensed milk in relation to infant feeding, which it is hoped will be published this year; and a more general inquiry has been begun in regard to proprietary infant foods, the results of which will be published as early as practicable.

prepare such food under the safest conditions that explains in large measure the lower infant mortality among the non-industrial classes.

If mother's milk, or failing this, artificially prepared food of appropriate composition could always be secured for infants, a chief cause of excessive infant mortality would have disappeared.

There are, however, avoidable causes of excessive infant mortality besides improper feeding. The striking differences in the death-rate in the first month of life have already been discussed (pages 39, 67 and 69). A large share of this difference is due to lack of intelligent care in early infancy, and to overcrowding, dirt, and unnecessary exposure to extremes of temperature, much of which can be avoided by intelligent care on the part of the mother.

On this point Dr. Newman's words may be quoted:—

It is not external environment which primarily affects the infant mortality, and produces that prematurity, pneumonia, atrophy, and much of the diarrhœa which occur in infant life. These things are produced by some evil condition or conditions in the habits and homes of the people, which are, after all, the vitals of the nation.*

This quotation represents one aspect of a profound truth, as does also Dr. Reid's statements (see page 101) that—

there is one cause (of excessive infant mortality) which far exceeds all others in potency, namely, the prevailing ignorance among mothers as to the proper feeding of infants.

The association of ignorance with excessive infant mortality is further suggested by the national statistics as to the number of married women who still sign the marriage register by mark. In the two columns in the following table counties with the highest and lowest infant death-rates are arranged, the proportion of illiterate women being given for each:—

Counties of Highest Infant Mortality.	Number of women in 1,000 marriages signing by mark. Average of 10 years—1898–1907.	Counties of Lowest Infant Mortality.	Number of women in 1,000 marriages signing by mark. Average of 10 years—1898–1907.
Glamorgan	41	Oxford	13
Durham	33	Hereford	21
Northumberland ...	29	Berkshire	13
Monmouth	43	Dorset	15
Staffordshire	33	Wiltshire	13
Yorks, W. Riding ...	33	Hertfordshire ...	14
Lancashire	32	Buckinghamshire ...	13
Cumberland	21	Surrey	8
Carnarvon	38	Sussex	8
Derby	19	Gloucester	20

Although the test cannot be regarded as satisfactory, there does appear in the above list a somewhat significant relation between a high infant mortality and a high proportion of illiterate wives. It is, however, specialised intelligence which is required for the successful rearing of infants, not skill in pen-writing; and on this

* "Child Mortality in relation to the Health of the State." *Journal Royal San. Institute*, Vol. XXX., p. 433.

point Dr. Reid's remarks (on page 102) should be read. With Dr. Mills' remarks (page 97) on the need for strenuous action in a propaganda of education in the moral and hygienic aspects of motherhood all will agree.

Ignorance is less serious if the mothers are teachable. On this point medical officers of health appear to differ in opinion. Reference is made by some to the apparently invincible prejudice in favour of the advice given by untrained midwives or by older mothers. A more hopeful note, and one I believe more in accord with the prospects of the future, is struck in the remarks of Dr. Dawes, of Longton, quoted on page 103. There can be little doubt that if the teaching of the principles of health were to form an essential part of the training in all elementary day schools, and if domestic teaching for the older girls could be secured in continuation classes, great improvement would soon be seen. Apart from definite teaching of hygiene as a separate subject, the fact that teachers are acquiring the knowledge needed to enable them to view their entire work from the standpoint of the scholars' health is a most favourable augury for the future. Even more so is the medical inspection of the schools under the Education (Administrative Provisions) Act, for this implies that teachers will have the need for the application of the principles of preventive medicine brought steadily before them. The direct carrying out of ameliorative measures and the training of both teachers and pupils in hygiene which this must imply will have far-reaching effect on the health of infants in the next generation.

The hopeful view is confirmed by the remarks of Dr. Smith, of Ryton (page 91), who is of opinion that in that part of Durham there has been an increasing appreciation of the value of infant life and an increasing abstinence from unnecessary resort to artificial feeding.

Ignorance is commonly associated with carelessness and indifference, the true explanation of which is a lack of appreciation of the extent to which infant health depends on the steady adoption of simple hygienic precautions.

In the report of the Inter-Departmental Committee on Physical Deterioration (1904) this topic was fully discussed, the opinion being expressed (page 55) that there is no lack of evidence of increasing carelessness and deficient sense of responsibility among the younger women of the present day.

It is doubtful if there is any such general increase. In every stratum of society self-indulgent, extravagant, idle, and ignorant women are to be found; and they represent a serious amount of national weakness. Among the wage-earning classes, the risk to child welfare is much greater when these maternal failings exist than when maternal default can be replaced by paid help.

There is happily no sufficient evidence that such mothers form an increasing proportion of the total mothers of the land; but their existence serves as a reminder that the prevention of infant mortality is largely a moral problem, as well as a problem in public and personal hygiene, and that until local Sanitary and Education Authorities and parents alike realise their full respon-

sibility in the matter, progress will not be completely satisfactory. The responsibility of the Local Authorities consists in efforts to provide a decent environment for every home; in the training of scholars, especially of the elder girls, in domestic economy and hygiene; in arranging for visits, soon after the birth of infants and at intervals afterwards, of competent and tactful health visitors. The parents are responsible for abstinence from such indulgences as will lower the standard of domestic life by leaving insufficient margin for adequate housing, food and clothing. They are responsible also for the intelligent use of every available means for the improvement of personal health, including domestic cleanliness and their share in the sanitary control of the district in which they dwell.

General Summary.

The preceding study of child mortality in England and Wales is obviously incomplete and preliminary in character. It has only been practicable to investigate the statistics of a single year, 1908, and it has been found necessary to leave the statistics of each of the greater towns and of London for separate later consideration.

Even so far as the administrative counties and their rural and urban divisions are concerned, the lessons derivable from tables I. to IX. in Appendix III. have not been exhausted: and a number of lines for further investigation open out of this preliminary report. It is hoped that the county medical officers of health now being generally appointed under the terms of the Housing and Town Planning Act, as well as district medical officers of health, will find this report a useful starting point for intensive investigation of the causes of excessive child and especially excessive infant mortality in their individual counties and districts. I use the word *excessive* advisedly; for every county and most districts whose experience when summarised as a whole show a low infant mortality have within their borders areas in which infant mortality is excessive. Hence although in this report certain rural counties have been employed as standards of merit, these standards are no more than relatively meritorious. The same remark applies to towns which, as a whole, have a low infant death-rate.

The subject of child mortality is of national importance. As shown by the statement below, one out of three deaths at all ages occurs under five years of age, one out of five during infancy, and one out of nine total deaths at all ages occurs under three months of age.*

Infant mortality is the most sensitive index we possess of social welfare and of sanitary administration, especially under urban conditions.

A heavy infant mortality implies a heavier death-rate up to five years of age; and right up to adult life the districts suffering

* In England and Wales out of 100 deaths at all ages in 1908, 11·6 per cent. occurred in the first three months of life, 4·3 per cent. in the second three months, and 5·9 per cent. in the second half of infancy. Altogether 21·8 per cent. of the total deaths at all ages occurred in infancy. Of the same total 9·8 per cent. occurred in the next four years of life 1–5, 7·7 per cent. in the 20 years 5–25, 12·3 per cent. in the 20 years 25–45, 20·5 per cent. in the 20 years 45–65, and 27·9 per cent. at ages 65 and over.

from a heavy child mortality, have higher death-rates than the districts whose infant mortality is low (pages 9-17).

A careful study of the death-rate in England and Wales during the last fifty years at each of the first five years of life, leaves it doubtful whether any appreciably greater selection or "weeding out" is exercised by a heavier than by a lighter infant mortality. Any such effect, if it exists, is concealed behind the overwhelming influence exerted by the evil environment to which children are exposed in districts of high infant mortality. It is strictly correct, therefore, to say, that a high infant mortality implies a high prevalence of the conditions which determine national inferiority (page 1 and pages 78-83).

This being so, the counties of Glamorgan, Durham, Northumberland, and Monmouth, and to a somewhat smaller extent the counties of Carmarthen, Staffordshire, Lancashire and the West Riding of Yorkshire are—happily to a decreasing extent—centres of national weakness (page 17).

A study of the causes of death which act in excess during infancy shows that this influence of the chief manufacturing and mining counties in lowering the standard of national efficiency need not continue (pages 24-34).

There is no essential causal relation between a high birth-rate and a high rate of infant mortality (pages 48-49).

The counties which have a high death-rate during the second half of infancy, usually have also a high death-rate in the first month of life (page 39).

There are strong reasons for concluding that much of this mortality in the first month of life is preventible, if appropriate action is taken (pages 39, 67 and 69).

Early motherhood is associated to a minor extent with a relatively high infant mortality (pages 52-54).

Infant mortality is higher among the poor than among the well-to-do, although natural feeding of infants is probably more general among the former (pages 54-56).

The statistics hitherto available for the counties considered in this report do not enable a definite statement to be made, on the basis of statistics, as to the influence on infant mortality of the non-domestic employment of mothers. Such employment must, however, tend on balance to increase infant mortality and to lower the standard of health of older children in the same family. Even when the mother's earnings are necessary for the bread-winning of the family, such earnings are secured by some sacrifice of the interests of the next generation. The industrial employment of married women, so far as can be judged from the statistics for counties, under present conditions weighs less heavily as a cause of excessive infant mortality than the influences next to be summarised (pages 56-59).

Infant mortality is always highest in crowded centres of population; but a high infant mortality can, subject to the conditions stated at the foot of page 62, be avoided even under conditions of dense aggregation of population (pages 60-63).

The chief means for a low infant mortality are efficient domestic and municipal sanitation, good housing, and intelligent and painstaking "mothering."

Infant mortality is highest in those counties where, under urban conditions of life, filthy privies are permitted, where scavenging is neglected, and where the streets and yards are to a large extent not " made up " or paved (pages 63-68).

Thus local sanitary authorities are largely responsible for the continuance of excessive infant mortality, and until they fulfil satisfactorily their elementary tasks, efforts in the direction of domestic hygiene can only be partially successful.

In the counties of Durham, Glamorgan, and Northumberland nearly one out of every five deaths of infants is due to diarrhœa. Diarrhœa is most prevalent when municipal sanitation is bad. It cannot be entirely removed unless infants' food is prepared under absolutely cleanly conditions.

Breast feeding is the greatest natural protection against infant mortality. It is not a complete protection, in part because breast-fed infants are often exposed to excessive changes of temperature in air-polluted rooms; and in part because mothers frequently give their breast-fed infants other food of an unsuitable character.

Recommendations.

1. The statistics given in this report emphasise the importance of more detailed investigation of all deaths occurring in infancy, as a guide to administrative action. This is already done in some districts; in other districts such deaths are ignored unless due to infectious diseases.

2. In each district an effort should be made to ascertain the number of still-births, and to investigate where practicable the circumstances connected with these and with the deaths of infants in the first month of life. The administration of the Midwives Act and of the Notification of Births Act offers many opportunities for inquiry, the results of which may be made of immediate value in public health administration.

3. Inquiries under the last head will throw light on the character of the attendance available for women during childbirth, and on the availability of additional help when required. So far no exact information is obtainable* as to the probable relation between the conditions under which childbirth occurs and the number of deaths in the first week of life.

4. The evidence already available points to the conclusion that infant mortality can be lowered by giving adequate training and help to midwives. This especially applies to the saving of infant life at and soon after birth. It has also to be remembered that the midwife's influence with the mother, whom she has helped in her need, is very great; and it is her advice as to the management and particularly as to the feeding of the infant which is most likely to be followed.

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* It is hoped that the investigation now being made for the Board by Dr. Darwall Smith, Physician to the British Lying-in Hospital, into the nutrition of the mother and other factors influencing the vitality of infants and their progress in the first 14 days of life may throw some light on the above points. This investigation is based on an analysis of several thousand births occurring in lying-in hospitals.

5. Although this is so, experience is already showing the value of the work being done by health visitors, who, under present conditions, form an almost indispensable aid in influencing mothers in the management of their infants.

6. The adoption of the Notification of Births Act is a necessary preliminary to the giving of such aid promptly; and I hope that ere long this Act will be generally adopted in country districts as well as in large towns.

7. The efficient administration of the Midwives Act, the adoption of the Notification of Births Act and of additional arrangements for giving instruction in infant hygiene are urgently called for in the counties in which infant mortality is excessive.

8. The measures indicated above furnish an incomplete remedy in the counties in which insanitary conditions are rife. Sanitary authorities in compactly populated districts should decide to remove all dry closets if a water-carriage system is practicable, to introduce and maintain efficient scavenging, and to provide for the satisfactory paving of streets and yards when required. Doubtless these measures will be expensive; but they are much more economical than the sickness and impaired efficiency of the population which are their alternative; and no sanitary authority can justify neglect in undertaking these elementary tasks.

9. Sanitary authorities in the words of Sir John Simon, the first Medical Officer of this Board, are the "appointed Guardians of masses of human beings whose lives are at stake in the business." As tested by excess of infant mortality, the sanitary authorities within the following administrative counties and in the following districts are most urgently called upon to perform more completely their primary duties.

Administrative Counties.	Sanitary Districts within Administrative Counties.
Glamorgan ...	Aberdare, Rhondda, Maesteg.
Durham ...	Willington, Consett, South Shields R.
Northumberland	Earsdon, Bedlingtonshire, Morpeth.
Monmouth ...	Abercarn, Bedwellty, Abertillery.
Carmarthen ...	Newcastle-in-Emlyn, Llanelly R., Llandilofawr R.
Staffordshire ...	Tunstall, Darlaston, Burslem, Longton.
Yorks, West Riding. ...	Featherstone, Monk Bretton, Royston.
Lancashire ...	Orrell, Hurst, Skelmersdale.

Doubtless in each of those counties there are sanitary authorities already doing their duty; but their influence on the statistics of each entire county, so far, is concealed in the total results.

The list should be made larger, and this could be done by reference to the statistics given on pp. 83-109. The urgency is greatest in the counties and towns enumerated above.

It will be noted that no attempt has been made in this report to assess the full value of the work done under the Notification of Births Act. That can be better done in a later report, when further experience has been obtained. That this work is most valuable, I have no doubt; but a warning may be given against over-confident measurement of local results in terms of statistics on the basis of a short experience. As a large portion of infant

mortality is due to ignorant or careless neglect of simple hygienic measures, such limited statistics are scarcely needed to prove that encouragement in the adoption of such measures must lead to improvement.

Nor have I attempted in this report to describe the admirable work in direct attack on infant mortality done by many municipalities, in connection with municipal milk depôts, schools for mothers, infant consultations, and allied organisations. These must be reserved for consideration in a later report, in which infant mortality in large towns will be specially considered.

APPENDIX I.

On the possible Selective Influence of Mortality in Infancy on Mortality in the next Four Years of Life.

The statistics in Table X., page 142, lend themselves to a more strictly mathematical study of the possibility that the variations in infantile mortality, owing to varying environment, may exercise a selective influence on the children surviving beyond the first year of life. Mr. G. Udny Yule has kindly contributed the following notes on this subject. His main conclusion, which is stated on page 82, is that there is little definite evidence of such selection beyond the second year of life, and that after the third year the environmental influences even of infancy alone appear to preponderate over any possible selective influence.

As has been pointed out (pages 13-14), the high degree of correlation between the mortality of infancy and of childhood in different districts indicates that selection is at least not so effective as to counterbalance the effect of a continued bad environment; where the character of a district is such as to cause a high infantile mortality, it will also cause a high mortality in after-life. At the same time it remains an interesting, and an important, question what the subsequent history of two populations would be, as regards mortality, if the diversity of conditions could be limited to the year of infancy alone, and it is in this question that the problem of the present Appendix consists. Further, it is necessary to remember that the influence of unfavourable conditions during infancy can hardly be a purely selective one. An adverse environment does not act merely like a breeder of dogs who selects the best from the litter, to be nurtured with every care, and destroys the weaklings at once: on the contrary, while it kills some, it will weaken many of the survivors also. All that we can hope to obtain from statistical data is some measure of the resultant influence of the environment of infancy: if a higher infantile mortality appears to be followed by a relatively lower mortality in the second and following years of life, the unfavourable conditions being removed, we may say that there is a *net* selective influence: if, on the other hand, even though the unfavourable conditions be removed, the mortality continues high, then clearly there is no net selective influence, but the weakening caused by the unfavourable conditions during the first year of life predominates.

Now it might be argued that the data of Table X. show at once that there is no net selective influence, for the very low mortalities during the second and later years of childhood that have been observed during the last two or three years have been accompanied and preceded by low, not by high, infantile mortalities. This may be, however, a gross and not a net result (resembling the correlation observed between the mortalities of infancy and of childhood in different districts) due merely to a common improvement in the conditions of life during infancy and childhood. The effect of such slow changes can be eliminated if we consider, instead of these slow changes, the changes that take place from one year to the next. A brief investigation of such changes suggests that, during the later years of childhood at least, any selective or other influence of the precedent infantile mortality must be relatively small, for the changes from year to year in the mortality of the fourth year of life are so closely consilient with changes in the mortality of the fifth year that both must be due, almost wholly, to the simultaneous changes in the conditions of life (the weather, epidemics, and so forth): there is little scope left for any great influence of the previous history of the two child populations. The following coefficients of correlation between the annual movements in the mortalities of the first five years of life illustrates the point more clearly:—

Coefficients of correlation between simultaneous annual changes in the mortalities of the successive years of life:—

First year and second year	+ 0·57
Second year and third year	+ 0·69
Third year and fourth year	+ 0·86
Fourth year and fifth year	+ 0·95

It will be seen that the co-efficients steadily increase. The correlation between simultaneous changes in infantile mortality and mortality of the second year of life is relatively low: the two rise and fall together to a large extent, but by no means so closely as to exclude some influence on the latter of the infantile mortality during the preceding interval. When we come to the fourth and fifth years of life, on the other hand, the correlation reaches the very high value 0·95, the influence of changes in common conditions being almost overwhelming.

To proceed rather further, let us correlate the changes in the mortality of each year of life with the changes in the infantile mortality to which the given child-population was subjected, *i.e.*, the changes in the mortality of the second year of life with the changes in infantile mortality a year earlier, the changes in the mortality of the third year of life with the changes in infantile mortality two years earlier, and so on. The coefficients are given below together with their "probable errors": too much stress must not, however, be laid on such probable errors in view of the small number of observations (52 to 49).

Correlation between changes in mortality of second year of life and changes in infantile mortality a year before	− 0·41 ± 0·078

Correlation between changes in mortality of third year of life and changes in infantile mortality two years before	+ 0·014 ± 0·094
Correlation between changes in mortality of fourth year of life and changes in infantile mortality three years before ...	+ 0·031 ± 0·095
Correlation between changes in mortality of fifth year of life and changes in infantile mortality four years before	+ 0·15 ± 0·095

It will be seen that the first coefficient alone is negative, the remaining three being very small and positive. This might be taken to indicate that infantile mortality exerted a marked selective influence on the mortality of the second year of life, while in later years there was no selective influence, and possibly the weakening influence of the unfavourable environment predominated to some slight extent. But such a conclusion, especially as regards the first part, might be seriously in error. Suppose for a moment that infantile mortality had no effect whatever, good or bad, on the mortality of the second year of life, but that the mortality both of infancy and of the second year of life rose and fell together *in alternate years* under the influence of fluctuating conditions: evidently under such circumstances we should get a high negative correlation between the movements in infantile mortality and the movements in the mortality of the second year of life a year later, notwithstanding the assumed absence of selection. Something very similar happens in the present case: the mortality of infancy does not always rise and fall in alternate years, but there is a high negative correlation (− 0·67) between the movement in successive intervals—higher than the value (− 0·5) which would be expected if large and small values of the mortality followed each other at random—and there is also considerable correlation between the simultaneous movements of infantile mortality and the mortality of the second year of life. We cannot, then, necessarily assume that the first coefficient given above indicates a selective influence, nor can we be quite certain of the significance of the remaining coefficients.

The change in mortality of any one year of life may, in fact, be supposed to depend on changes in two conditions at least: (1) changes in the corresponding (preceding) infantile mortality; (2) changes in the environment (weather, &c.). To obtain a fair measure of the influence of the preceding infantile mortality, we should eliminate the effect of changes in environmental conditions, *i.e.*, we should obtain the *partial correlation*, as it termed, between changes in the mortality of the given year of life and changes in infantile mortality, the change in environmental conditions—or such conditions themselves—being fixed. The question arises, then, in what way we are to measure the changes in environmental conditions. No entirely satisfactory way of doing this has occurred to me: the only possible way seems to be to take the changes in mortality of some other year of life as the measure of change of conditions. This has the obvious disadvantage that the changes in mortality of any year of life are,

ex hypothesi, not due to changes in the existing conditions alone, but also to the past history of the population exposed. Probably, however, as it seems from the preceding argument, the influence of the past history of the population is relatively small, and to a first approximation the measure may serve. As a test of the selective influence of infantile mortality on, *e.g.*, the mortality of the second year of life, we may then calculate the partial correlation between changes in infantile mortality and changes in the mortality of the second year of life a year later, the *simultaneous* changes in infantile mortality or in the mortality of the third year of life being fixed. The following table shows the whole series of coefficients calculated on this method; the title of the table is to be read straight across from left to right:—

Changes in the Mortality of the Year of Life named below,	taking as a Measure of Changes in conditions the Changes in Mortality of the year of Life named below,	exhibit with Changes in the Infantile Mortality to which the Child Population was subjected—	
		a partial correlation.	a partial regression.
Second year ...	First year ...	− 0·046 ± 0·093	− 0·026 ± 0·053
	Third year ...	− 0·39 ± 0 080	− 0·146 ± 0·033
Third year ...	Second year	− 0·20 ± 0·091	− 0·041 ± 0·019
	Fourth year	+ 0·43 ± 0·078	+ 0·059 ± 0 012
Fourth year ...	Third year ...	+ 0·37 ± 0·082	+ 0·039 ± 0·0093
	Fifth year ...	+ 0·42 ± 0 079	+ 0·027 ± 0·0057
Fifth year ...	Fourth year	+ 0·21 ± 0 092	+ 0·012 ± 0·0054

It will be seen that, in the case of the second and third years of life, the results differ a good deal according as we take the changes in the mortality of the preceding or of the following year of life as a measure of changes in conditions. In the case of the second year of life, however, both coefficients are negative, and this may perhaps be taken as indicating with some probability a net selective influence of infantile mortality. The influence is not, however, a great one at the most, even allowing that, for various reasons, the greater coefficient of the two given may be the nearer to the truth. As shown by the "partial regression," a rise of 1 unit in the infantile mortality only corresponds on an average, for constant conditions, to a fall of 0·146 units a year later in the mortality of the second year of life at the most, or a rise of ten units in infantile mortality to a fall of roughly 1·5 units in the mortality of the second year of life. In the case of the mortality for the third year of life, the two coefficients, obtained by taking changes in the mortalities of the second and fourth years of life, respectively, as measures of changes in conditions, differ in sign: the discrepancy is a large one compared with the probable error and the result can only be written down as uncertain. For the fourth year of life, both coefficients are fairly

large and positive, and for the fifth year of life the one coefficient that can be given is positive also. The figures suggest that, after the third year of life, the weakening influence of the conditions that cause a high infantile mortality preponderate over the selective influence. The result seems a perfectly possible one if the mortality of infancy is selective only as regards the special dangers of infancy and its influence scarcely extends beyond the second year of life, whilst the weakening effect of a sickly infancy is of greater duration. But the statistical basis is too slight, and the case too complex to enable one to put forward such a conclusion, on the basis of these figures alone, as anything but a very tentative hypothesis.

Summary Statement of Correlation Coefficients and Standard Deviations used in the preceding work.

Second year of life.—

1. Annual changes in infantile mortality. 2. Annual changes in mortality of second year of life a year later. 0. Annual changes in infantile mortality a year later. Total correlations: $r_{12} = -0{\cdot}41$; $r_{01} = -0{\cdot}67$; $r_{02} = +0{\cdot}57$. Partial correlations : $r_{12{\cdot}0} = -0{\cdot}046$; $r_{01{\cdot}2} = -0{\cdot}58$; $r_{02{\cdot}1} = +0{\cdot}44$. Standard deviations : $\sigma_1 = 10{\cdot}94$; $\sigma_2 = 5{\cdot}64$; $\sigma_0 = 10{\cdot}92$. 52 observations.

1. Annual changes in infantile mortality. 2. Annual changes in mortality of second year of life a year later. 3. Annual changes in mortality of third year of life a year later. Total correlations : $r_{12} = -0{\cdot}40$; $r_{13} = -0{\cdot}18$; $r_{23} = +0{\cdot}69$. Partial correlations : $r_{12{\cdot}3} = -0{\cdot}39$; $r_{13{\cdot}2} = +0{\cdot}14$; $r_{23{\cdot}1} = +0{\cdot}69$. Standard deviations : $\sigma_1 = 11{\cdot}00$; $\sigma_2 = 5{\cdot}62$; $\sigma_3 = 3{\cdot}03$. 51 observations.

Third year of life.—

1. Annual changes in infantile mortality. 3. Annual changes in mortality of third year of life 2 years later. 2. Annual changes in mortality of second year of life 2 years later. Total correlations : $r_{13} = +0{\cdot}014$; $r_{12} = +0{\cdot}22$; $r_{23} = +0{\cdot}69$. Partial correlations : $r_{13{\cdot}2} = -0{\cdot}20$; $r_{12{\cdot}3} = +0{\cdot}29$; $r_{23{\cdot}1} = +0{\cdot}70$. Standard deviations : $\sigma_1 = 10{\cdot}83$; $\sigma_2 = 5{\cdot}62$; $\sigma_3 = 3{\cdot}03$. 51 observations.

1. Annual changes in infantile mortality. 3. Annual changes in mortality of third year of life 2 years later. 4. Annual changes in mortality of fourth year of life 2 years later. Total correlations : $r_{13} = +0{\cdot}051$; $r_{14} = -0{\cdot}19$; $r_{34} = +0{\cdot}86$. Partial correlations : $r_{13{\cdot}4} = +0{\cdot}43$; $r_{14{\cdot}3} = -0{\cdot}46$; $r_{34{\cdot}1} = +0{\cdot}89$. Standard deviations : $\sigma_1 = 10{\cdot}89$; $\sigma_3 = 2{\cdot}88$; $\sigma_4 = 2{\cdot}22$. 50 observations.

Fourth year of life.—

1. Annual changes in infantile mortality. 4. Annual changes in mortality of fourth year of life 3 years later. 3. Annual changes in mortality of third year of life 3 years later. Total correlations : $r_{14} = +0{\cdot}031$; $r_{13} = -0{\cdot}18$; $r_{34} = +0{\cdot}86$. Partial correlations : $r_{14{\cdot}3} = +0{\cdot}37$; $r_{13{\cdot}4} = -0{\cdot}41$; $r_{34{\cdot}1} = +0{\cdot}88$. Standard deviations : $\sigma_1 = 10{\cdot}90$; $\sigma_3 = 2{\cdot}88$; $\sigma_4 = 2{\cdot}22$. 50 observations.

1. Annual changes in infantile mortality. 4. Annual changes in mortality of fourth year of life 3 years later. 5. Annual changes in mortality of fifth year of life 3 years later. Total correlations: $r_{14} = +0{\cdot}016$; $r_{15} = -0{\cdot}12$; $r_{45} = +0{\cdot}95$. Partial correlations: $r_{14{\cdot}5} = +0{\cdot}42$; $r_{15{\cdot}4} = -0{\cdot}43$; $r_{45{\cdot}1} = +0{\cdot}96$. Standard deviations: $\sigma_1 = 10{\cdot}65$; $\sigma_4 = 2{\cdot}21$; $\sigma_5 = 1{\cdot}97$. 49 observations.

Fifth year of life.—

1. Annual changes in infantile mortality. 5. Annual changes in mortality of fifth year of life 4 years later. 4. Annual changes in mortality of fourth year of life 4 years later. Total correlations: $r_{15} = +0{\cdot}15$; $r_{14} = +0{\cdot}089$; $r_{45} = +0{\cdot}95$. Partial correlations: $r_{15{\cdot}4} = +0{\cdot}21$; $r_{14{\cdot}5} = -0{\cdot}17$; $r_{45{\cdot}1} = +0{\cdot}95$. Standard deviations: $\sigma_1 = 10{\cdot}72$; $\sigma_4 = 2{\cdot}21$; $\sigma_5 = 1{\cdot}97$. 49 observations.

APPENDIX II.

Summary of the Relative Position of the different Counties in respect of Infant Mortality.

The following summary states the main features of the infant mortality in each administrative county. Tables I. to IX. (Appendix III.) on which this summary has been chiefly based have been compiled from reports of medical officers of health. Death-rates for other years than 1908 have been obtained from the annual summary of the Registrar-General.

Glamorgan.

During 1908 the administrative county of Glamorgan had a death-rate at ages under 1 week 2·1 per cent. in excess, under 1 month 14·4 per cent., under 3 months 19·1 per cent., 3-6 months 46·2 per cent., 6-12 months 33·0 per cent., and for the entire first year 28·2 per cent. in excess of that of England and Wales. The excess under the heading of different diseases and groups of diseases was as follows:—

Measles + 89·5 per cent., whooping cough + 34·0 per cent., diarrhœal diseases + 36·2 per cent., atrophy, debility, and marasmus + 64·7 per cent., convulsions + 103·7 per cent., bronchitis and pneumonia + 21·1 per cent. Premature birth was a smaller cause of death to the extent of 22·1 per cent.; congenital defects of 11·9 per cent., and tuberculous diseases of 12·8 per cent., than in England and Wales as a whole.

The death-rate at ages 1-5 years was 25·8 per cent. in excess of that of England and Wales.

In the urban districts of the administrative county the death-rate was 164·8, in the rural districts it was 124·5; in the county boroughs of Cardiff and Swansea it averaged 134·7 per 1,000 births.

Of the two county boroughs Cardiff had an infant death-rate of 124 (143 in 1898-1907), Swansea of 151 (159 in 1898-1907).

The rural districts having the highest infant death-rates were Gelligaer and Rhigos 159, Pontardawe 141. Among the urban districts the highest infant death-rates were in Aberdare 213 (191 in 1903-07), Rhondda 183 (177 in 1903-07), Merthyr Tydfil 173 (192 in 1898-1907), Maesteg 173 (192 in 1898-1907), and Pontypridd 169 (158 in 1903-07).

Extracts or Summaries from Annual Reports of Medical Officers of Health.

Dr. Williams, the County medical officer of health, gives the following summary of the causes of high infant mortality:—

(*a*) Early marriages.

(*b*) Improper feeding, clothing, and care of the infant, the latter being due to ignorance, and not so much to lack of care.

(*c*) Ante-natal conditions affecting the unborn child through the mother, *e.g.*, alcoholism, syphilis, and employment of mothers outside the home, &c.

(*d*) Want of skilled assistance during and after labour.

(*e*) Domestic evils, dirty and overcrowded houses, neglect of parents on account of intemperance.

(*f*) Insanitary surroundings.

(*g*) The substitution of artificial for breast feeding, thus incurring the evils which attend the use of an often unsatisfactory and adulterated milk supply.

(*h*) Indifference on the part of parents to the dangers of measles, whooping-cough, diarrhœa, &c.

That overcrowding and insanitary conditions are important factors in bringing about this high infantile mortality in the industrial districts of the county cannot be disputed, and as these are evils capable of being remedied, no efforts should be spared by sanitary authorities to cope with them.

Among the remedial measures indicated are:—

I.—Instruction in the laws of health, including the feeding and care of infants, thrift, temperance, and moral instruction to the higher standards for girls, and the formation of continuation classes in these subjects.

II.—The education of the expectant mother as to personal health, the importance of suckling, and the care of the infant generally.

III.—The distribution of leaflets on the feeding and care of infants, &c.

IV.—The control and supervision of milk supplied to infants that are artificially fed.

V.—The notification of all births to the medical officer of health within 48 hours.

VI.—Better methods of protection of infant life, especially—

(*a*) Those born out of wedlock and farmed out.

(*b*) The registration of still-births.

(*c*) The removal of infants from undesirable parents, and

(*d*) The provision of skilled assistance at birth.

VII.—Special attention to the cleansing of streets, flushing of gullies, and the early and complete removal of all offensive accumulations, especially during the summer months.

The work of reducing this appalling mortality of infants should not be left to sanitary and education authorities only. It is a work in which the parents should be made to realise their responsibilities, and in which social, philanthropic, and religious institutions have great opportunities of assisting. It is only by the hearty and intelligent co-operation of municipal and social efforts that the best results can be obtained.

Without wishing to disparage such remedial measures as mentioned above, I would point out that there are other causes at work tending to the deaths of infants, which are preventible by other means than the instruction of mothers on how to feed their children. Amongst these causes may be the fertile growth of diarrhœa germs on animal and vegetable refuse during the warm weather, and their transference to the artificially-fed infants' foods by dust and flies.

Nature's remedy during 1908 has been a cold summer, preventing the growth of these germs, and copious rain, washing away the organic refuse.

Our remedy should be the thorough scavenging of organic refuse from the vicinity of dwellings, and the seeing that the infants have food which cannot be contaminated, *i.e.*, the mother's breast-milk.

Possible Causes of High Infant Mortality.—Referring to the high infant mortality which averaged 190 in the ten years 1898-1907, Dr. Jenkins, the medical officer of health of Rhondda, remarks:—

A high infantile mortality is usually found in industrial urban centres, and is commonly associated with a high birth-rate, overcrowding of houses on space and of individuals in houses, and with the employment of married women in industrial occupations which necessitate a daily absence from home for long periods. With the exception of the first-mentioned, and, to a less extent of the overcrowding in individual houses, these influences operate but slightly in this district; the birth-rate, however, is higher than that of any other of the 76 great towns.

Diarrhœa.—Dr. Jenkins points out the desirability of regarding—

the figures pertaining to diarrhœa only as part of the larger subject of infantile mortality, in that by far the greatest number of the deaths from diarrhœa occur among children under one year of age.

and adds:

From the point of view of the sanitarian, special interest and importance attach to diarrhœa as a cause of death in the very young because of the possibility of preventing the vast majority of the deaths from this cause by the adoption of comparatively direct and easily applicable measures. It may be added that the successful application of the means directed against the causes of diarrhœa will as certainly, though perhaps not as potently, favourably affect the influence which some, if not all, of the other most important causes exert upon the infantile mortality rate.

It may be safely asserted that by far the most common cause of deaths from diarrhœa among infants is the want of proper care in the selection, preparation and the administration of their food. This assertion is supported by the fact that a relatively small percentage of breast-fed infants succumb to this complaint.

Dr. Jenkins' further remarks under the heading of scavenging and refuse disposal complete the explanation of the causation of excessive infant mortality from diarrhœa:—

With the exception of about 16 tons, which are daily burnt at the destructor situated at Ystrad, the large amount of house refuse collected throughout the district is deposited at about 12 tips, distributed more or less conveniently within the limits of the urban district.

Practically all these tips are in more or less close proximity to the main roads of the district, and the majority of them within 50 yards of dwelling houses. The council are annually becoming more appreciative of the fact that the existing conditions are unsatisfactory, and the health committee's time and attention during 1908 have very largely been given to a consideration of the respective merits of the two methods, on either or both of which it is recognised that the council's choice must ultimately fall.

The two methods referred to are the erection of destructors and the making of more remote dumping grounds, and on the latter of these Dr. Jenkins remarks:—

Large masses of decomposing house and other refuse will serve as breeding grounds for myriads of flies, and it is doubtless within the recollection of the council that such pests did the flies derived from an adjacent refuse tip prove to be to a great number of people that, largely for that reason, the council were obliged to abandon the use of that tip. Although the greater distance from dwelling houses at which it is intended to place the tips associated with rope-ways will doubtless serve to reduce the extent of the invasion of the houses by flies, such distance cannot be made sufficiently great to altogether obviate the nuisance as well as positive danger which their presence as carriers of disease germs occasions.

Dr. J. M. Morris, in his report on Neath Urban District, makes the following remarks as to *untrained midwives*:—

There are far too many children brought into the world in modern times whose sole mission seems to be to suffer needlessly. The occurrence of three deaths recently within a fortnight of infants under three weeks old from the disease known as "white mouth," from which no healthy infant—there are extremely few infants unhealthy at birth—ought to suffer, but which practically every child of the working or poorer classes has to suffer from, is only an incident in what is nothing less than a scandal. I have frequently pointed out that whilst the untrained midwife, with her habits and superstitions, is allowed to foist herself on the community the present condition of things must endure. In this connection I think that it is more than "wondrous strange" that women of notoriously drunken habits—and we have several of them in Neath—should be allowed to practise this profession.

Dr. W. Kirby, in his report on Maesteg Urban District, names the following factors as contributing to a high infant mortality:—

An unsatisfactory milk supply, defective sanitary conditions both in and around the houses, ignorance on the part of parents as to the rearing and clothing of infants and exposing them in unfavourable weather.

Dr. T. W. Thomas (Caerphilly Urban District) enumerates "early marriages, intemperance, and improper feeding both on the part of the mother herself and also in giving unsuitable food as a substitute for milk" as having much concern with excessive infant mortality.

Dr. A. Duncan (Merthyr Tydfil Borough) states:—

Refuse tips.—The refuse tip forms a most excellent breeding ground for both flies and germs. In houses near the tip flies are a veritable pest in summer and autumn, and especially in houses with limited pantry accommodation it is practically impossible that milk and other foods can escape being contaminated. In previous reports it has been pointed out that to escape the ravages of this disease it was necessary to have a high standard of both municipal and domestic cleanliness, but as regards the former no advance has been made, as tipping instead of destruction of the refuse is still going on. In the matter of domestic cleanliness an improvement may be expected from the visits of our health visitor.

He adds on page 31 of his report for 1908, "the various refuse tips are still in use."

Housing conditions are unsatisfactory. Thus—

As in previous years we have been faced with the difficulty of a dearth of houses, especially of houses with a rent sufficiently low to suit the circumstances of tenants who would have been displaced from slum areas. For this reason certain areas such, for example, as Crystal Palace Court, have not been dealt with, as the rents of the houses vary from 8*s.* to 12*s.* per week, and there are no empty houses anywhere in the vicinity with rents approximating these figures. Owing to this dearth of houses, closing orders had often to be postponed to allow tenants to find houses elsewhere.

Dr. T. Mitchell (Swansea Rural District, Llandilo-Talybont division) in his report says:—

Improper feeding.—The deaths from enteritis and gastro-enteritis number one-fifth of the whole, and a very large proportion of those are doubtless due to improper feeding. Convulsions accounted for practically one-fourth of the infant mortality, and digestive disorders are the most common causes of convulsions in infants.

The dummy teat.—A fruitful source of danger to infants is the use of the dummy teat, which, when it falls to the ground, is often replaced in the infant's mouth without being adequately cleansed. No married women are employed in the works of this district. Very few women who are physically fit to suckle their children omit to do so in this district.

Reference may also be made to Dr. S. W. Wheaton's report in 1908 (No. 308) to the Local Government Board on the Sanitary Circumstances of Maesteg Urban District. He states that it has the typical appearance of a South Wales coal mining town, the people being prosperous, wages high, and no empty houses. Water-closets are in use throughout the district, but are mostly hand flushed. A large number of these are "in such a filthy condition that no self-respecting person could use them." House rent is very dear, and the provision of houses has a speculative element, for "owing to failure of a colliery from accident or exhaustion, to a prolonged strike, or to depression in the coal trade, hundreds of houses may be empty for years. Again, there is the risk of damage to dwellings by subsidence." He adds that "the oldest and most dilapidated houses belong, as a rule, to the colliery companies."

There is usually no drainage of the yards of houses, which are kept in a very unsatisfactory condition. Very few of the streets are "made," and the back streets are "all unmade," "Often it is impossible to reach the houses without getting covered with filth. It is noticeable that few persons alight from Maesteg Station without being provided with leggings or jack-boots, and these are very necessary."

The following description deserves to be quoted in full. It describes a condition of affairs, not uncommon in Glamorganshire, which goes far to explain its excessive infant mortality.

In order to get a dry footing people throw ashes out of their front doors, which in turn gives rise to nuisance. The condition of the back streets is still more filthy, because a great deal of liquid and solid refuse is thrown to them or escapes from the yards bordering them. In some instances liquid manure from stables escapes into the back street. They are also, in some parts of the district, resorted to for purposes of defæcation, and in the wet warm weather become quagmires of filth, giving forth a disgusting odour. The history of many a household now living under filthy conditions frequently is as follows :—The parents have come in the prime of life from a rural district, being tempted by the high rate of wages in the mining districts. They are not accustomed to have water laid on, to use water-closets or drains, or to dispose of their house refuse except by burying it in the garden. Directly they arrive in the district they find a difficulty in obtaining house room. Only the worst class of house is available for them, perhaps because the wages of the husband at first are rather low, or perhaps because they are afraid of the high rent required for a decent house. They go into a filthy house, almost before the former tenants have left it, situate in a street which for a great part of the year is a black slough, with a stinking back street in the rear, with a filthy water-closet, and a yard covered with filth, hoping to obtain a better house by waiting; but no better house becomes available, and in their ignorance and inability to combat the deteriorating influences to which they are exposed, it is not surprising that they often lose their self-respect, take to drink, and become degraded. These deteriorating influences are more powerful in the case of the women than of the men, because they are always at home and have no recreation or amusement. There is little to encourage the women in their fight against dirt, which is continually brought into the houses from the filthy streets and back streets, and also by their husbands, with perhaps their sons and a lodger, returning from the pit in their soiled clothes. No baths are provided for the colliers at the pits, nor are there baths in their houses. There is no employment for women in the district, but the infant mortality which together with the birth-rate has shown a tendency to decrease of late years, is still high, and the average infantile mortality for the last ten years has been 152 per 1,000 births. This may be compared with a rate of 61·3 in a rural district in Wiltshire,

which I inspected just before Maesteg. In both cases there was no occupation for women, and many of the causes to which a high infant mortality is attributed are absent in both instances. In Wilts the average wage was 13*s.* per week only, whereas in Maesteg it is, as I am informed, 40*s.* per week. In many parts of Maesteg young children are terribly neglected, and in consequence are very debilitated."

Dr. Spencer Low, reporting to the Board of Aberdare Urban District (No. 259, 1907), says:—

Excrement Disposal and Removal.—A few outlying houses are provided with midden privies or with pail closets, emptied at the discretion of the occupiers. All other houses are furnished with water-closets. New houses are provided with proper flushing boxes for the water-closets, but closets of the older houses are hand flushed. In such cases the pans were very often found to be foul and in some instances they were in an extremely objectionable condition. As long ago as 1894 Dr. W. Williams, medical officer of health for the County of Glamorgan, reported in "A Sanitary Survey of Glamorgan" upon a number of matters requiring the further attention of the Aberdare urban district council. Among them, he pointed out the desirability of making byelaws under Section 23 of the Public Health Acts Amendment Act, 1890, with regard to the keeping of water-closets supplied with sufficient water for flushing. Dr. Williams drew attention in this report to the fact that the above Act enabled byelaws made with respect to closets and drainage to be retrospective as well as prospective. Owing to the length of time which has since elapsed, the filthy condition of the closet pans is now in all probability considerably worse than when Dr. Williams's report was made. Provision of flushing tanks has now become a matter of urgent necessity.

Durham.

During 1908 the infant death-rate was 151·0 in the administrative county, 25 per cent. in excess of that of England and Wales. In the urban districts of the county the death-rate was 147·2, in the rural districts 155·6; in the four county boroughs it averaged 137·9.

At ages under one week the administrative county had a death-rate 39 per cent. in excess; under 1 month 29·3 per cent.; under 3 months 21 per cent.; 3-6 months 31 per cent.; and 6-12 months 30 per cent. in excess of that of England and Wales.

The excess under the heading of different diseases and groups of diseases was as follows:—

Whooping-cough + 32·0 per cent., diarrhœal diseases + 35·2 per cent., premature birth + 18·6 per cent., atrophy, debility, and marasmus + 80·7 per cent., tuberculous diseases + 23·4 per cent., convulsions + 20·4 per cent., bronchitis and pneumonia + 24·0 per cent. The death-rate from measles was 5·3 per cent. and from congenital defects 4·5 per cent. less than that of England and Wales.

At ages 1-5 the death-rate was 22·4 per cent. in excess of that of England and Wales.

The districts having the highest infant death-rates in 1908 were as follows*:—

Urban Districts.—

Willington 242 per 1,000 births (281 births. Average rate 1898-1907, 165).

Consett 201 (372 births).

* Many of these rates are based on small data, as shown by the number of births on which they are based given in brackets. The extent to which the rates are exceptional may be judged by the mean rates also given whenever practicable.

Houghton-le-Spring 191 (366 births).
Stanley 191 (816 births. Average rate 1898-1907, 173).
Brandon and Byshottles 191 (662 births. Average rate 1898-1907, 174).
Southwick-on-Wear 182 (581 births. Average rate 1898-1907, 181).
Durham 176 (449 births).

Rural Districts.—
South Shields 195 (400 births).
Houghton-le-Spring 187 (902 births. Average rate 1898-1907, 98).
Chester-le-Street 177 (2,809 births. Average rate 1898-1907, 174).
Sedgefield 161 (1,095 births. Average rate 1898-1907, 166).

County Boroughs.—
Gateshead 149 (Average rate 1903-07 was 154).
South Shields 129 (Average rate 1903-07 was 153).
Sunderland 144 (Average rate 1903-07 was 147).
West Hartlepool 144 (Average rate 1903-07 was 142).

Extracts from Annual Reports of Medical Officers of Health.

Dr. Eustace Hill, the county medical officer of health, made a special report in 1907 on the high infant mortality in the administrative County of Durham, from which the following remarks are taken:—

An examination of the causes of infant deaths and of the ages at which they occur indicates that many of them cannot be prevented by any action taken by local authorities for protecting the child *after birth.* For instance, the great proportion of the deaths from premature birth occur under the age of one week.

It must be admitted, also, that a large proportion of the deaths of infants under three months cannot be prevented by any action of sanitary authorities whatever powers of supervision they may obtain, as owing to abnormalities, want of development, or lack of vitality, neither careful attention nor proper feeding can save their lives, though it is highly probable that had the mothers taken greater care of their health, and lived under more hygienic conditions, a healthier offspring would have resulted.

The chief causes generally regarded as acting adversely on the infant population are heredity, illegitimacy, insurance, poverty, employment of women, high birth-rate, insanitary conditions and overcrowding, alcoholic intemperance, improper feeding, dirty milk, and neglect and inexperience of the mother.

Whatever the effect of heredity, illegitimacy, and child insurance on infant mortality, it is certain that these causes do not operate any more prejudicially in this county than in the rest of the country, for the proportion of illegitimate births is comparatively small, and I have no evidence, and cannot believe, that infant insurance is effected by our working population with any object of money gain by the death of the infant. Poverty may also be excluded as a special factor in this county, for the wages of our working population are considerably higher than in the rural parts of England, where the infant mortality is comparatively low, and, moreover it is a noticeable fact that the infant mortality rate has often been lower during periods of trade depression than when wages are high, food cheaper, and pauperism less.

Similarly, the proportion of women, and especially married women, industrially employed in this county is very small, and yet our infant mortality exceeds that for Lancashire, West Riding and Staffordshire, where the proportion of married women engaged in factories and workshops is very much higher.

Dr. Hill makes the following important statement:—

Overcrowding.—I am fully convinced that the gross overcrowding in many of the mining districts of the county, especially when associated with insanitary dwellings, is one of the chief factors of our continued high infant death-rate.

Streets and Scavenging.—After stating that "the sanitary state of the County has of recent years been very materially improved as regards housing, water supply, sewerage, and drainage" Dr. Hill adds "there is still much room for improvement in all these matters, as well as in the condition of front and back streets, conveniences, yard paving, scavenging, control of milk supply, etc." He remarks on the lower infant mortality in the boroughs as being "the result of better paving of streets and back yards, better scavenging and generally of more adequate sanitary supervision than obtains in the rest of the County."

Mismanagement of infants and Condition of Houses.—Improper feeding and management of infants are potent factors in infant mortality, but in Durham—

they cannot be altogether dissociated from the gross over-crowding which exists, and they are intimately connected with the housing problem. It is of very little use urging the necessity of pure milk and air on mothers condemned to live in wretched dwellings where fresh air and cleanliness are impossible, and where no provision is made for the proper storage of food.

Ante-natal Conditions.—Dealing with the high mortality from premature birth Dr. Eustace Hill refers to the possibility of this being due in part to "unsuccessful means taken to prevent conception and procure abortion"; but thinks that in Durham the chief reasons for high mortality under this heading are "to be found in some other ante-natal conditions affecting the mother, of which the most likely, in my opinion, are overcrowding and insanitary dwellings."

Dr. Hill's classification of the causes of and remedies for infant mortality may be usefully compared with those already given:—

To sum up, the causes of infant mortality in this country are:—

1. *Ante-natal*, which include:—
   - Early marriages.
   - Constitutional weakness on the part of the parents.
   - Insanitary surroundings.
   - Intemperance.
   - The use of abortifacients (possibly).
2. *Post-natal*, which include:—
   - Structurally defective and insanitary dwellings.
   - Overcrowding.
   - High birth-rate.
   - Improper feeding.
   - Impure milk supply.
   - Want of domestic cleanliness and care.
   - Intemperance on the part of the parents, leading to poverty and neglect.

And the chief remedies include:—

- Better housing and sanitary surroundings.
- The prevention of overcrowding.
- A purer milk supply.
- Restriction in the use as an infant food of skimmed condensed milk.
- Systematic instruction in our elementary schools in domestic hygiene and temperance.
- Early notification to sanitary authorities of all births.
- The registration of still-births.
- The appointment of women health visitors.
- The suppression of immoral advertisements.

Dr. Hill's statements may be supplemented by those of district medical officers of health in the county. Thus, Dr. Taylor, the medical officer of health of the Chester-le-Street Rural District, dealing with the Sanitary Authority's share in permitting a heavy infant mortality, says:—

Responsibility of Sanitary Authorities.—The aim of your council should be in the future, as in the past, the abolition of ashpit-privies, places which disseminate injurious organisms, the paving of dank, insanitary back yards, and the improvement of the houses of the people. The people themselves can do much, but progress in cleanliness is slow, very slow, amongst the people in general.

Look at scores and scores of these back yards, the worst in structure adjoining the worst houses, see the filthy condition of the ground there, covered with fæcal matter of the children, the parents too lazy and too careless to see and enforce their children using the proper places, and for which purpose the ground in the vicinity of the house is used. In addition to this pollution, the yard is too often the dwelling place of poultry, rabbits or dogs, all polluting the soil and rendering it the very best breeding place of those very organisms which kill the young infants of the community.

Dr. Stobo (quoted by Dr. Hill) in writing of the high death-rate of 230 per 1,000 births in the parish of Tunstall, in the Sunderland Rural District—

Exposure of Infants.—Strongly condemns the practice of mothers who insist on taking out young children in the night air, in all weathers, and frequently also insufficiently clothed.

Negligence or Ignorance?—Dealing with the large number of deaths from debility and allied affections Dr. Stobo says:—

> "Generally speaking the children who die from these causes may be divided into two classes: (*a*) The congenitally weak children born with an inherent weakness which all care and attention will fail to overcome. Their death should not honestly be deplored, either for their own sakes or that of their friends; (*b*) those who have been perfectly strong at birth, but from parental negligence or carelessness, or ignorance, generally pine away. It seems to be the hardy annual in the reports of health officers to protest against the continued ignorance of the mothers in the feeding of their young. Yet the dawn of a better day seems to be appearing. By some means the knowledge of how to feed the child is being diffused, and, in my opinion, the fatal results are more due to negligence or indifference than ignorance."

And he adds that he is persuaded that the latter class (*b*) is in the majority.

Dr. J. W. Smith (Ryton Urban District) makes the following hopeful remarks:—

Increasing care.—I am inclined to think that during the last few years there has been an increasing appreciation of the value of infant life, and a growing desire on the part of mothers to bring up their children on the breast, instead of too readily resorting to the feeding bottle, largely due to the assistance and advice of the district nurses and medical attendants, given to young mothers as to the care and bringing-up of children.

Dr. A. M. Vann (Durham Urban District), writing of the high diarrhœal mortality, says:—

Cleanliness in the home.—Most important of all probably is the lack of cleanliness of infant feeding apparatus, of house interiors and general surroundings. A very great deal, as will be seen by reference to previous reports, has been done in late years in the way of abolition or improvement of ashpits and in the draining and paving of yards to render the surroundings of houses more sanitary, but as yet I cannot say that, speaking generally, there is a corresponding improvement in that cleanliness of house interiors which is dependent on the efforts and habits of the tenants themselves.

The difficulty of keeping houses in a sanitary condition here is increased by the fact that the town being in the centre of a colliery district with several pits within walking distance, the poorer type of workman who does not stay perhaps

long enough at one colliery to obtain a house there, elects to live in the town, moving frequently from house to house and not always leaving the last in as good a condition as when he entered.

It is high time that tenants should recognise the duty of doing their part in helping to keep their dwellings and yards in a cleanly state. Domestic refuse and filth should not be thrown about a yard, nor gullies and channels blocked or broken as is so constantly the case. Water-closets again should not be used as receptacles for broken jars and other discarded domestic articles.

Dr. A. Smith (Whickham Urban District) says:—

Aid of District Nurses.—I feel confident that a great factor in this decline in infant mortality has been the interest excited by the agitation in favour of the establishment of district nurses now happily crowned with success, such nurses to act also as lady health visitors. The holding of many public meetings for discussion, the talks outside, &c.. have markedly created a new public opinion in favour of greater care of babies from birth onwards, and this has to my own notice, greatly increased breast feeding. It is significant in this connection that only in the districts where the subject was taken up with enthusiasm by the mass of the people has the great decline in infantile mortality occurred.

Dr. Horne (Stockton-on-Tees Urban District) states that in 1908 for the first year on record no privies nor pan closets have been built in connection with new houses, adding:—

Triumph of Water-carriage System.—More convincing evidence of the redemption of the public in regard to its views upon sanitary conveniences than this could hardly be desired. It would, I think, be quite correct to say that 15 years ago a large, probably a preponderating, section of the local community was quite apathetic on the question; indeed, I fancy it would not be much wide of the truth were it stated that a majority of the local public was at that time hostile to the adoption of water-closets and in favour of one or other of the so-called conservancy methods. Even among those who at that period constituted the health authority it was but a comparatively small band of progressive, enlightened sanitarians who consistently and persistently advocated the superiority of the water-carriage system over the midden and pan privy and who maintained, frequently against formidable opposition, that the system was practicable for your district.

Dr. Clayton (Gateshead County Borough) writing in his annual report on the fact that 40·5 per cent. of the total infant mortality in 1909 was due to premature birth, congenital debility and defects says:—

Unskilled Midwives a cause of Still-births.—This only strengthens the arguments I have used year after year, that parents are not giving that care to themselves for the sake of the infant to be born which is necessary. Certainly we have passed during this last year through great hardships and deprivation in many parts of the borough, yet I am more than ever convinced that at the very foundation of the matter lies the desire of parents to restrict the number of their children.

The matter looks blacker still when we take into account the fact that of 924 labours conducted by the registered midwives, 45 were still births, and seeing that they attended only 23·2 per cent. of the total births registered, we are safe and well within bounds in assuming than at least 100 still births occurred. To my mind, therefore, it would appear, if we would search deeply for the causes of this infantile waste we should have compulsory notification of all still births where the fœtus has reached the viable age. This would certainly bring to light many important factors.

Dr. Johnstone reporting to the Board* on the sanitary circumstances of the rural district of Easington gives particulars, of which the following extracts illustrate the worst conditions:—

Housing.—The great majority of houses are colliery cottages . . . a great many old dwellings exist, of which large numbers are dilapidated, damp, and

* New Series, No. 20, 1909.

faulty in construction. In places like Castle Eden Colliery and Haswell, where the colliery has been shut down, the houses are allowed to fall into disrepair, many of them being even broken up and sold for the materials, although the majority continue to be occupied.

Almost everywhere there is ample air space around the houses. Usually there is a wide front street and back street. In the centre of the latter the privy middens or ash closets are situated when they are not placed within the house yard. In some villages there are gardens behind the houses, but this is unusual.

Although overcrowding upon area is not a feature of the district, overcrowding of persons in houses is not infrequent. This arises generally from insufficiency of houses in the vicinity of collieries, and from the custom of taking in lodgers . . . Speaking generally, the colliers keep the inside of their houses with great neatness and cleanliness. It is only when the dwelling itself is so damp and dilapidated as to dishearten the occupier that an unclean interior is found.

Excrement disposal.—For the most part this is effected by privy middens. The latter are usually without roofs and are of large size. They are not often over full but many are dilapidated and some of the privies are, from this cause, quite unfit for use. Generally a privy has to serve two houses but instances were seen where four or more houses used the same privy. Of late years many of the privy middens have been converted into ash closets.

Sewage.—The system of conveying away sewage by means of open channels, has been the occasion of correspondence between the county council and the rural district council . . . These open channels are generally made of shaped tiles, and are usually carried down the back streets in a double line, one channel outside the back of each row of houses. Very often the back street is of great width, containing the privy middens in the centre, and it sometimes happens that the open channels are a considerable distance from the back doors of the houses. In such circumstances, slops are often thrown outside the doors with, no doubt, the pious hope that they will eventually reach the channel.

Roads and back-streets.—As a general rule, only through routes in colliery villages are repaired by the district council. This leaves the bulk of the roads and streets on which the houses face to be repaired by the owners. In many instances the front streets have never been made up, there are no footpaths, and the condition of things is very bad in wet weather. But it is in the back streets that the conditions are most serious. They are hardly ever made up, beyond the laying down of some ashes over the rough clay, and in wet weather they are usually quagmires. In most colliery villages the back streets serve as the means of access to the houses, both for their occupants and for tradesmen delivering goods, and form, in addition, the children's playground; there also are generally situated the privy middens, during the scavenging of which the ground around is liable to frequent fouling. The front streets are devoted to clothes-lines for hanging out washing, and save for this are usually a desert so far as human use or occupation is concerned. It is, in fact, evident that as regards the health and comfort of the inhabitants, the paving, channelling, and making up of the back streets is much more important than that of the front ones. From a rough calculation made for me by the medical officer of health, it appears that there are some 15 miles of back streets in the rural district, practically none of which are properly made up or paved.

Dr. Fletcher reporting to the Board on the Brandon and Byshottles Urban District* states:—

There are large numbers of old-fashioned privy ashpits in the district, some of the ashpits being covered and some uncovered, some serving one or two privies and others serving three or four. Many are dilapidated and many are sources of serious nuisance.

Speaking generally, a vast amount of work is required to bring the closet accommodation into anything like a satisfactory condition. There are very few water-closets in the district.

Neglect of Sanitary Authority.—The district council have for a long time past allowed unwholesome conditions to prevail, and until recently, when stirred up by epidemic enteric fever at Brandon Colliery, they have done comparatively little to improve the surroundings of the inhabitants, and even

* No. 260, 1907.

yet have done little elsewhere than at Brandon Colliery, where their attention has been confined, practically, to improvements in drainage and closet accommodation. The council does not appear to have considered it necessary to take any steps, seriously at any rate, to secure better housing accommodation, which is one of the most urgently required reforms.

Dr. Darra Mair* reporting to the Board on the Whickham Urban District states:—

Excrement Disposal.—The cleansing of privies, ash-pits, and cesspools is carried out by men employed by the district council. Privy middens and cesspools are emptied once a month; ash-closets and house refuse ash-bins once a week.

In some cases the contents of these receptacles have to be conveyed through the dwelling, and in many others they have to be deposited upon the ground prior to removal; but in the case of newer houses, back streets have been provided, which usually prevent the necessity of either of these objectionable procedures . . . .

Housing.—It seems to be the fact that the people of the Whickham Urban District, and those of Northumberland and Durham generally, not only live in very small houses, that is to say, in houses with but few rooms, and that they live much crowded together in these small houses, but also that there is no other district in provincial England and Wales to compare with or even to approach them in these respects. The deduction seems inevitable that for such very exceptional conditions to exist in Northumberland and Durham, either the people there must have a lower standard of comfort and decency than those elsewhere in the country, or social and economic forces must be at work there, the effects of which accustom the people to, or directly and indirectly lead them to bear with, such lower standard.

"*Free House*" *System.*—In the first place, the very fact that proprietors of collieries are known to be responsible for the provision of houses for their workmen must interfere with the building of houses by private enterprise.

It seems also obvious that, even when houses are built by private enterprise, they would approximate fairly closely in character to the "rent-free" houses erected by colliery owners—there would be no incentive, at any rate, to compete with them and to provide better houses at the same rent, such as might be expected in places where there there was no "free" house system.

In the second place, it seems but natural that colliery owners should seek not to build more houses than are absolutely necessary, seeing that they receive no rent for them; and also not to lay out more capital than is absolutely necessary on the houses which they do build. As a consequence houses have been built with as few rooms as possible. This phase of the question is more acute than it was even 30 or 40 years ago, since it costs more to build a house now.

It will seem to most people that these two results of the free-house system must be inevitable, and that they alone must have an enormous influence on the housing accommodation generally. On the one hand, there is the miner anxious to have a free house if there is one available, or, if there is not, anxious for a house the rent of which is as nearly equal to his rent allowance as may be; on the other hand, there is the owner anxious to meet his obligation to provide house accommodation for his men with as little capital sunk in the process as is possible, and the private builder unlikely, under the circumstances, to risk his capital unless he sees there *must* be a demand for his houses or unless he is prepared to get but small return for his capital.

The two factors tend, unfortunately, in the same direction. One a natural desire to build as few and as small houses as possible, the other an equally natural tendency to be satisfied with such accommodation as these houses can be made to yield. With the operation of two such factors extending over a great length of time, it becomes no matter for surprise that the standard of comfort and decency among the people generally is, as the census returns indicate, lower than that prevailing among the working class generally, and also lower than that prevailing among those engaged in similar occupation in colliery districts elsewhere. . . . Recently the Northumberland miners have voted "dead

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* No. 262, 1907.

against" the abolition of the "free house." The system is there, and even if it could be abolished to-morrow its effects would last for some time; so that the housing question has to be dealt with in spite of it.

Dr. Reece reporting to the Board on Hebburn Urban District* remarks:—

In such backyards, frequently within a few feet of larder windows, there are midden privies of large size, uncovered and sloppy from rain and added water. Objectionable as these midden privies always are, as they exist in some of the streets of Hebburn Colliery district they constitute a most serious nuisance.

Dr. Fletcher reporting on Chester-le-Street Rural District† says:—

With respect to cleanliness of the houses internally, everything depends on the occupiers. In very many cases, it may not be an exaggeration to say generally, the miner and his womenfolk are "house-proud" people, and they certainly make the most of their very limited accommodation. The dwellings of miners of this class are kept scrupulously clean, and many of them are really well and tastefully furnished. On the other hand, instances are not infrequently observed in which squalor, filth, scanty furniture, dirty clothes and bedding, and apparent poverty are the prevailing characteristics. As a class, however, and bearing in mind their inferior house-accommodation, and depressing surroundings of pit-mounds and black coal-dusty paths, roads, and open spaces about their houses, and the general absence of gardens, the miners and their wives deserve credit for their indoor cleanliness and tidiness, a condition the maintenance of which involves much labour in dry and windy weather when everything becomes smothered with coal-dust.

Unquestionably prompt and very energetic action ought to be taken to improve the deplorable housing of very large numbers of miners and their families in this rural district, and I am of opinion that the greatest incentive to thorough reform on the part of the coal companies would be the adoption by the District Council of Part III. of the Housing of the Working Classes Act, 1890; the adoption of Part III. and the commencement of building operations by the council would spur on the companies. Apart, however, from this result, I see no reason why the District Council should not be able to build houses, and to let them at remunerative rents if the married miners were not compelled to pay rent, indirectly, to the companies, and then a second time to other landlords if they elect to reside in a non-colliery house. The council have, in my opinion, erred in not adopting the Act just mentioned, and would do well to reconsider their decision.

Northumberland.

During 1908 the infant death-rate in the administrative county was 147·3, 22·3 per cent. in excess of that of England and Wales. In the urban parts of the county the infant death-rate was 155·3, in the rural parts 126·8. In the county borough it was 139·4.

At ages under one week the administrative county had a death-rate 34·6 per cent. in excess, under 1 month 31·3 per cent., under 3 months 22·7 per cent., 3-6 months 20·3 per cent., 6-12 months 23·2 per cent. in excess of that of England and Wales.

The death-rate from the following diseases was over the average: whooping cough + 14·0 per cent., diarrhœal diseases + 34·2 per cent., premature birth + 19·1 per cent., atrophy, debility and marasmus + 74·7 per cent., tuberculous diseases + 23·3 per cent., convulsions + 23·2 per cent., bronchitis and pneumonia + 5·9 per cent. From measles the death-rate was 57·9 per cent.,

* No. 318, 1908. † No. 250, 1907.

and from congenital defects it was 19·4 per cent. below the average.

At ages 1-5 the death-rate was 5·7 per cent. in excess of that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—
Tynemouth 159 (births 819).
Morpeth 158 (births 520).

Urban Districts.—
Morpeth 214 (births 226).
Earsdon 227 (births 392).
Bedlingtonshire 221 (births 784).
Newbiggin-by-the-Sea 214 (births 84).
Seghill 214 (births 56).
Ashington 203 (births 809).
Hexham 180 (births 211).

The infant death-rate in the county borough of Newcastle-on-Tyne was 139 (average rate 160 in 1898-1907).

Extracts from Reports of Medical Officers of Health.

Dr. Hembrough, the county medical officer of health, writes:—

It is much to be regretted that so few sanitary authorities have seriously considered the advisability of adopting the Notification of Births Act, and that the great majority appear to view with complacency a death-rate of children during the first month of life of about 55, and during the first year, of anything up to 200 per thousand births. If such a mortality were to take place among lambs, a Royal Commission would be appointed and measures would be adopted for preventing such an unnatural mortality. Lambs, however, are frequently worth fifty shillings each when six months old; apparently babies are not.

The following extract is taken from Dr. Hembrough's summary of conditions in Berwick-upon-Tweed:—

Privies and pail closets always bad.—The authority is perfectly aware of the nuisances and danger to health arising from the filthy pail closets and ash middens which the medical officer thus describes in his annual report for 1908:—The very best of them are bad, and cannot be improved so long as the present system obtains. It is my opinion, as medical officer of health, that each and every one of these pail closets and ash middens is a nuisance to the locality and injurious to the health of the persons who are compelled to use them. It makes no matter how the scavengers endeavour to keep them, the stench is intolerable and constant, and poisons the air in their immediate vicinity . . . There are middens between Nos. 130 and 166, Main Street, used by 16 families, comprising 166 persons, which are so very objectionable that the owners ought to receive their notices immediately. So long as these insanitary places are to be found in Spittal, I cannot say it is in a sanitary state.

Tweedmouth is not drained, and is, therefore, worse than Spittal with regard to its pail closets and ash middens, and I am sorry to have to state that, at their last quarterly meeting, the authority rescinded the application to the Local Government Board for borrowing powers for a supply of water to the inhabitants, so that now this town, which, for the last twenty years, has been asking for a supply of water, seems to be as far away as ever from it.

The sanitary authority excuses the above-mentioned conditions because of the insufficient water supply, and, as regards procuring a remedy for the last-mentioned condition, the weary wrangle in the council goes on year by year, some members being of opinion that it is the duty of the sanitary authority to supply the whole of the houses within its area with a reliable supply of water, sufficient for domestic and flushing purposes, while others are of opinion that

Tweedmouth and Spittal should utilise the abundant water supply which is supposed to exist on the spot, but the whereabouts of which neither committees nor individuals can locate.

Dr. Dickie (Morpeth), after pointing out that, during the year under review, almost every fourth child born died under one year of age, and that a large portion of these deaths was attributable to epidemic diarrhœa or allied complaints, continues:—

Epidemic Diarrhœa.—The causes of epidemic diarrhœa have been referred to in all previous reports; the climatic conditions predisposing to it cannot be altered, but the existing causes, careless feeding, unsuitable and unnatural foods, and want of cleanliness still remain. More direct instruction of the young mothers, either in their earlier life at school, or more particularly by district nurses and the like, the provision of sterilized pure milk, and so forth, are remedies usually suggested. The adoption of the Act of Parliament requiring the early notification of births would, of course (but only if properly supplemented by the appointment of a nurse or nurses), be of service.

Dr. Stumbles (Amble), in connection with an investigation of the prevalence of diarrhœa, says:—

The memory of one child, between four and five months old, being fed with suet pudding, I shall not readily forget.

Dr. Mills (Ashington) observes:—

Education required.—The climatic conditions favoured the spread of diarrhœa, the congested housing, the proximity of ashpits and privies, the innocent carelessness of mothers too young to be such, the reprehensible habit of taking advice from one and all except the doctor, and the manifest want of care in infant dietary all increase our difficulties. These infants are the raw material of good workmen and mothers; they are the potential workers of the next generation, the main asset in a working community. I am sorry to state that there does not exist the same feeling of national loss as a corresponding adult death roll would call forth, and yet it is the raw material that requires the greatest nourishing and tending. To combat this, strenuous action is required in a propaganda of education in the moral and hygienic aspects of motherhood. A great deal of this can be done at school, and more can be done by evening continuation classes for girls, and still more by the parents taking up this obligation. The self-reliant mother can afford to do without the precarious advice of those old dames and neighbours whose experience without knowledge exacts its toll in disease and infant lives. This education of mothers in domestic hygiene, in the administration of pure food, and in their responsibility to themselves as mothers, can be attained by the local authority in the provision of trained health visitors.

Dr. Trotter (Bedlingtonshire) observes:—

Abominable roads and back streets.—The deplorable condition of many of the roads in the colliery villages and in the back streets in bad weather is largely responsible for the colds caught which leads to the swelling of our death returns from respiratory diseases. It is not a credit to the district that this state of affairs is tolerated from year to year. . . . I say without hesitation that the existing condition of many of the roads and pathways in many of our colliery villages is no credit to our vaunted civilisation, and how the authorities can prosecute parents for not sending their children to school in bad weather over such roads and paths passes the average comprehension.

He adds:—

The abolition of numerous insanitary and dilapidated privy ashpits which still exist in almost every sub-district, and the roofing over and internal cementing of others are measures urgently needed.

The county medical officer of health, commenting on the unsatisfactory sanitary circumstances and administration in Newbiggin-by-the-Sea, remarks:—

Privies and Defective Scavenging.—It is probable that the extremely high infantile mortality rate which is recorded has been prejudicially influenced by the scarcity of water, and it is claimed by the local authority that many of the

insanitary conditions (privy middens, blocked drains, &c.) which undoubtedly influence this rate, cannot be effectually dealt with until an increased water supply is obtained.

In addition to the number of insanitary privy ashpits to be found, the system of scavenging—by contract—again proved unsatisfactory, and numerous complaints were received. Scavenging by contract nearly always necessitates such an amount of supervision by the sanitary inspector as to seriously interfere with his other duties, and it has been proved that this work can be carried out by a sanitary authority more regularly, more satisfactorily, and also more economically than under the contract system. The scavenging of privy ashpits during the day time, the removal of their contents in uncovered carts, and the tipping of the refuse in proximity to houses, are not measures of which any town posing as a health resort can be proud.

The abolition of many foul privy ashpits, "several of them very wet and offensive at times," is a long delayed requirement still unfulfilled, the urgency of which increases with each successive year.

A high death-rate implies a high damage-rate.—Dr. Messer (Newburn) is quoted by the county medical officer of health as laying great stress upon the fact that conditions which bring about a high infant mortality rate necessarily imply a serious injury to the infants that do not die, those who just fail to succumb but who are reared in a state of hopeless malnutrition, resulting in the development of rickets. The latter disease is responsible, in infancy and childhood, for a large proportion of the cases of convulsions, adenoids, deformities of bones, including the chest walls and, later, of pulmonary tuberculosis (phthisis or consumption) and injuries to the nervous system resulting, in some cases, in enfeeblement of mind and insanity.

Ignorance.—Dr. Messer also points out that:—

The chief cause of malnutrition in infants is the ignorance of the mothers, resulting in the child being deprived of its proper nourishment, and in its being supplied with food which it cannot assimilate, resulting in a condition of semi-starvation and, too frequently, in death; he also recommends the adoption of the Notification of Births Act and its natural corollary, the appointment of a health visitor, as being the most practical means for lessening the vast amount of preventable sickness and mortality among infants "much of which most excellent work could be done in the district at the maximum cost of £60 in a half year."

Monmouth.

During 1908 the infant death-rate in the administrative county was 140·3, 16·5 per cent. in excess of that of England and Wales. In the urban parts of the county the infant death-rate was 147·0, in the rural parts 91·3. In the county borough it was 135·4.

At ages under one week the administrative county had a death-rate 4·5 per cent. below, and at ages under 1 month 1·5 per cent. below, while at ages under 3 months its death-rate was 9·8 per cent., at ages 3-6 months 20·3 per cent. and at ages 6-12 months it was 27·2 per cent. in excess of that of England and Wales.

The death-rate from the following diseases was over the average: measles + 26·3 per cent., whooping cough + 76·0 per cent., diarrhœal diseases + 11·1 per cent., atrophy, debility and marasmus + 35·3 per cent., convulsions + 46·3 per cent., bronchitis and pneumonia + 4·0 per cent. From premature birth the death-rate was 16·1 per cent., from congenital defects 41·8 per cent., and from tuberculous diseases it was 4·3 per cent. below the average.

At ages 1-5 the death-rate was 3·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural District.—

St. Mellons 122 (births 362).

Urban Districts.—

Abercarn 275 (births 367).
Bedwellty 190 (births 763).
Abertillery 178 (births 1,265).
Rhymney 151 (births 404).

The infant death-rate in the county borough of Newport was 135 (average rate 150 in 1898-1907).

Extracts or Summaries from Reports of Medical Officers of Health.

Dr. Rocyn Jones, the county medical officer of health, summarises the causes and means of reduction of high infant mortality as follows:—

I. *Sanitary.*—
(*a*) Insanitary environments;
(*b*) Overcrowding and filth.

These are important factors in industrial districts in producing a high infant mortality rate, and young children and infants are particularly prone to illnesses which owe their origin to these causes. Even in rural districts, where there is abundant sunshine and pure air, we find infants ailing when their home surroundings are subject to these causes.

2. *Social and Personal.*—
(*a*) Early marriages;
(*b*) Antenatal conditions affecting the unborn child through the mother. Intemperance by the parents. Syphilis in either parent or both;
(*c*) Unskilled assistance and attendance during and after labour;
(*d*) The substitution of bottle feeding and artificial food for breast feeding;
(*e*) Improper clothing and feeding, and neglect of the infant.

3. *Illnesses.*—
(*a*) Pneumonia, bronchitis, debility and convulsions;
(*b*) Indifference of the parents to the dangers of measles, whooping cough and diarrhœa.

These illnesses might, in a large percentage of cases, be avoided, were the parents to feed and clothe their children properly and avoid exposing them to cold and infection. Comment upon the frequency of death in children under a 12-month from these complaints is unnecessary, as unfortunately its incidence is too apparent to escape notice.

Means of Reduction.

Methods by which the rate of infantile mortality may be reduced can be classified under two heads:

1. *Sanitary.*—
(*a*) Improving the dwellings of the poorer classes;
(*b*) Early notification of births;
(*c*) Appointment of lady health visitors;
(*d*) Leaflets and cards with instructions for feeding baby;
(*e*) Municipal supply of sterilised milk.

2. *Educational.*

Dr. Howard Jones, the medical officer of health of Newport, writing of the 339 deaths of infants in 1908 asks:—

To what extent were these 339 deaths among infants preventible?

26 deaths were ascribed to Epidemic Diarrhœa—to a great extent if not entirely preventible.

11 deaths were ascribed to Enteritis—some of these were probably cases of epidemic diarrhœa, the majority of the others were due to errors in diet and hygiene—also preventible.

9 deaths were ascribed to Gastritis and Intestinal Catarrh—the same explanation applies to these cases as to the last group.

7 deaths were ascribed to Tuberculosis—another preventible disease.

27 deaths were ascribed to Whooping Cough—another preventible disease, but one which is so frequently treated as a trivial complaint, although next to measles and diarrhœa, the most fatal of the diseases of infancy.

1 death was ascribed to Scarlet Fever.—If the last group were treated with the same respect as is accorded to this one by the public generally many lives would be saved annually and much permanent ill-health prevented.

45 deaths were ascribed to Inflammatory Affections of the Respiratory Organs —to a large extent due to want of proper care on the part of parents particularly during and after attacks of whooping cough, measles, &c.

36 deaths were ascribed to Debility—largely preventible also, and due to want of care, overwork, preventible diseases, and want of proper nourishment during child bearing, and to want of proper care of infants during early weeks of life.

92 deaths were ascribed to Prematurity and Defects at Birth.—Some probably criminal, some accidental, and many otherwise preventible under healthy conditions of living.

44 deaths were ascribed to Convulsions—a symptom of many diseases, and occurs frequently when infants are improperly fed.

Such a record surely points to the necessity for some radical changes in the education of our girls so that they may be better prepared for their life work as wives and mothers of the nation. It also shows the necessity for organised attempts at improving the present standard of home and infant hygiene.

Carmarthen.

During 1908 the infant death-rate was 140·1 in the administrative county, 16·4 per cent. in excess of that of England and Wales. In the urban districts of the county the death-rate was 129·5, in the rural districts 146·9. There are no county boroughs.

At ages under one week the administrative county had a death-rate 18·1 per cent. in excess, under 1 month 17·6 per cent., under 3 months 20·2 per cent., 6-12 months 25·9 per cent. in excess; while at ages 3-6 months, the death-rate was 7·2 per cent. below that of England and Wales.

Under the following headings the death-rate was above the average:—

Measles + 152·6 per cent., atrophy, debility and marasmus + 74·7 per cent., tuberculous diseases + 17·0 per cent., convulsions + 170·4 per cent., bronchitis and pneumonia + 3·9 per cent.

The death-rate from whooping cough was 20·0 per cent., from diarrhœal diseases 36·7 per cent., from premature birth 35·2 per cent., and from congenital defects 47·8 per cent. below that of England and Wales.

At ages 1-5, the death-rate was 1·3 per cent. in excess of that of England and Wales.

In the urban districts the highest death-rates occurred in Kidwelly 143 (98 births), and Llanelly 133 (802 births).

In the rural districts the highest death-rates were Newcastle-in-Emlyn 246 (118 births), Llanelly 157 (782 births), and Llandilofawr 155 (744 births).

Staffordshire.

During 1908 the infant death-rate was 131·7 in the administrative county, 9·4 per cent. in excess of that of England and Wales. In the urban parts of the county the death-rate was 139·8, in the rural parts 97·1. In the county boroughs it was 140·0.

At ages under 1 week the administrative county had a death-rate 16·1 per cent. in excess, under 1 month also 16·1 per cent., under 3 months 13·2 per cent., and at 3-6 months 16·5 per cent. in excess; while at ages 6-12 months the death-rate was 3·4 per cent. below that of England and Wales.

Under the following headings the death-rate was above the average: congenital defects + 11·9 per cent., atrophy, debility and marasmus + 60·7 per cent., tuberculous diseases + 21·3 per cent., convulsions + 15·7 per cent. From measles the infant death-rate was 26·3 per cent., from whooping cough 22·0 per cent., from diarrhœal diseases 4·5 per cent., from premature birth 1 per cent., and from bronchitis and pneumonia it was 2·9 per cent. below the average for England and Wales.

At ages 1-5, the death-rate was 4·5 per cent. below the average for the country as a whole.

The urban and rural districts having the highest death-rates in 1908 were as follows:—

Urban Districts.—

Tunstall 211 (average rate 1904-07, 199).
Darlaston 200 (644 births).
Burslem 184 (average rate 1903-07, 184).
Longton 184 (average rate 1903-07, 204).
Fenton 176 (average rate 1904-07, 175).
Bilston 164 (average rate 1904-07, 192).
Smallthorne 164 (507 births).
Newcastle-under-Lyne 160 (611 births).
Willenhall 160 (576 births).

Rural Districts.—

Kingswinford 128 (623 births).
Mayfield 121 (83 births).

The death-rate in each of the *County Boroughs* was as follows:—

Burton-on-Trent 112 (average rate 1898-1907, 115).
Wolverhampton 132 (average rate 1898-1907, 159).
Smethwick 136 (average rate 1898-1907, 148).
West Bromwich 141 (average rate 1898-1907, 163).
Walsall 148 (average rate 1898-1907, 165).
Hanley 158 (average rate 1898-1907, 195).

Extracts from Reports of Medical Officers of Health.

Dr. Reid, the county medical officer, in his report for 1908 remarks:—

Ignorance of Mothers.—Of course, there are many contributory causes of excessive infant mortality, most of which are preventible, but there is one which far exceeds all others in potency, namely, the prevailing ignorance among mothers as to the proper feeding of infants. Some authorities in the county

have creditably done what lies in their power to break through this ignorance by appointing women visiting inspectors and providing courses of lectures on health subjects, with the assistance, in some cases, of the county education committee; but, commendable though such efforts are, I fear they are comparatively futile so far as the object aimed at is concerned. Experience, I fear, compels one to come to the conclusion that it is hopeless to attempt to educate the present race of mothers. At the same time, some good in this direction may ultimately result from the administration of the Midwives Act, for a midwife has great influence over mothers, and sound advice given during the early weeks of the child's life must, occasionally at any rate, bear fruit. No real headway will be made, however, until the rising generation of both sexes are systematically taught elementary health principles at school. The first step in this direction is to educate the teachers in order that they may be able to give the necessary instruction, and the Education Committee of this county are to be congratulated on having gone thus far. Under that committee Miss Curwen has been engaged for four years in conducting excellent classes on practical hygiene for school teachers, and the result of this work will, no doubt, soon show itself.

Tunstall, Darlaston, Burslem, Longton, and Fenton are the worst of the "black-list" towns as regards infant mortality in Staffordshire, and much interest attaches to the remarks of the medical officers of health of these districts on the subject, as quoted in Dr. Reid's report.

Dr. Partington, medical officer of health of Tunstall, writes:—

Factory employment of Mothers.—In commenting upon the causes productive of the excessive mortality, it has to be borne in mind that female factory labour is very much in evidence in Tunstall, and although much has been and is being done to lessen the injurious influences of such upon the constitutions of young women adopting factory work, it cannot be denied that these injurious influences are too often reflected upon the offspring of such as become mothers. The neglect of home life involved in the system must also be conceded as a baneful factor in the production of excessive infant mortality. Improvement in the conditions surrounding factory labour can only be done by legislation, so that our efforts must be chiefly directed to improve the home surroundings of the child.

He also states:—

Ashpits and defective Scavenging.—In some instances, owing to the existence of large ashpits, it is necessary to empty their contents into the street, prior to collection by the dust cart. This is a very objectionable and insanitary practice, and should be entirely abolished by the substitution of galvanized bins for the existing ashpits.

Continued progress is being made in the abolition of the privy system, no fewer than 126 having been converted to water-closets. From the year 1901 to 1908, 1,825 privy middens have been converted to water-closets.

Dr. Reid adds:—

The condition of things at Tunstall is not so satisfactory as it might appear to be from the above reference, as, unfortunately, it is the practice to sanction the introduction of hand-flushed closets, of which there are already 2,552 in the district. This is a highly objectionable type of closet, and steps should be taken to convert those which now exist into closets with proper water flush.

Dr. Partridge, medical officer of health of Darlaston, writes:—

Insanitary environment co-operating with Maternal ignorance.—For so many years has our infant mortality been excessive that there is a risk lest we regard it as an unavoidable tradition instead of viewing it as a feature of our public health administration that calls loudly for remedy, at any rate, as far as the causes operating in our own district are concerned.

In these days when so much is heard of a declining birth-rate and race deterioration the subject should claim our special attention, for it is one that possesses not merely local, but national significance. While there can be no question that year by year we can note real progress in our public health work,

yet it is, to say the least of it, very disappointing that with all our efforts and good intentions no impression is made upon the mortality of our infants.

Of the factors combining to produce this unsatisfactory state of things maternal ignorance in the feeding of children, coupled with insanitary environment, are the most powerful.

The organism of a child within the first year of its existence is so fragile and its power of resistance to evil influences so feeble that under favouring conditions it readily falls a victim to disease and death.

Recent legislation has provided in the Notification of Births Act, what will doubtless prove to be most beneficial in dealing with this question, enabling as it does, health authorities to keep in touch with the infant from within a few hours of its birth. This measure would be invaluable to us in this district.

Its adoption, of course, implies the necessity for a lady health visitor, whose duty it would be to instruct mothers in the feeding and management of their children.

Other points that should be considered in the endeavour to minimise the evil are the advisability of teaching hygiene to the senior girls of our schools; the safeguarding of our milk supplies; and what is of the most vital importance to us as a community, the adoption of an attitude of relentless hostility towards all that is embodied in the term "insanitary conditions," without a due appreciation of the importance of which all other considerations will be valueless.

These remarks must be read in conjunction with the following remarks by the medical officer of health on the privy system:—

Too much latitude is allowed in the matter of manure deposits. Most of the receptacles are too large and deep. They should be much smaller, and emptied more frequently than they are at present. They provide a favourite breeding ground for flies, and in consequence assist in promoting food contamination to an alarming extent.

The conservancy system as it exists in the old property of this district is most insanitary, and is doing more than anything else to retard our progress; and I am convinced that not until it has yielded to the water-carriage system shall we be justified in feeling any real sense of security.

Dr. Reid's comment is much to the point:—

In view of the above, it will be a standing disgrace to the county if the Darlaston District Council does not carry out to the full the recommendations of their medical officer of health, particularly as regards the more energetic and systematic abolition of privies and the adoption of the Notification of Births Act. Darlaston is one of our worst privy-midden towns, and relatively slow progress is being made in substituting the water-carriage system, which is the only permissible system for urban communities. Also, as regards the Notification of Births Act, it was framed with the intention of providing a means of combating infant mortality, and, in view of the gravity of the situation, unless the Darlaston District Council determine to adopt the Act it will become a question whether the county council should not take the initiative and bring the Act into operation in the district, as they are empowered to do..

The report of Dr. Dawes, medical officer of health of Longton, contains the following remarks of the lady sanitary inspector, which give a needed note of hopefulness to this discussion:—

Younger Mothers are teachable.—I have heard a great deal attributed to the ignorance of the young mother, but I find, as a rule, that the young mother can be fairly easily influenced. There is more opposition from the mother of the large family (though she may, perhaps, have buried most of them) or the ignorant grandmother. It is very difficult to overcome their prejudices, and they have a great deal of influence with the younger mothers. For instance, when visiting a baby suffering from diarrhœa, I was assured by the mother that she was carrying out the doctor's instructions implicitly, though she afterwards admitted, when the baby died, that she had been all along, on the advice of the grandmother, surreptitiously giving it unsuitable food because she "thought the doctor was starving it." This is just one of many of such instances.

On the whole, however, I think mothers are beginning to understand the simple laws of health, and what is required by an infant if it is to develop into

a healthy adult. Among the poorer classes it is one continued struggle against adverse conditions. Unwholesome dwellings, and poverty, which necessitates the mother leaving her baby to the care of others, have to be taken into account as well as ignorance, carelessness, and want of management.

Walsall.—Dr. Wilson, reporting on the excessive infant mortality (148 in 1908 and 165 in 1898-1907), says:—

There are several causes which conduce towards keeping up this high rate of mortality among infants, the principal of which are ignorance and want of intelligence on the part of the mothers in the management of their children, lack of cleanliness, the use of unsuitable foods, the substitution of bottle for breast feeding, the want of fresh air, especially in the overcrowded and poorer parts of the town, and the want also of proper medical attention in such diseases as measles, whooping cough, &c.

Burslem had an infant death-rate in 1908 of 183, in the ten years 1898-1907 of 201 per 1,000 births.

The annual report of the medical officer of health does not give sufficient information on the questions of housing and of excrement disposal to enable a quotation to be made. There are, however, still many privies, though some conversion into water-closets is going on. The sanitary inspector refers to the difficulty of disposing of the night soil, most of which is deposited on land outside the borough.

The medical officer of health states that he can bear out what the lady sanitary inspector says about—

The dirty condition of many of the homes, and I have often seen the dummy picked up from a dirty floor and pushed into the baby's mouth without any attempt at cleansing it. While in many of the houses there is inadequate accommodation for the storage of food, yet often when there is a proper place for keeping it, the milk is put into a cupboard next to the fire; and many times the milk is received into a dirty vessel.

West Riding of Yorkshire.

During 1908 the infant death-rate was 131·6 in the administrative county, 9·3 per cent. in excess of that of England and Wales. In the urban parts of the county the death-rate was 134·2, in the rural parts 123·6. In the county boroughs it was 136·8.

At ages under one week the administrative county had a death-rate 12·3 per cent. in excess, under 1 month 8·7 per cent., under 3 months 5·4 per cent., 3-6 months 11·9 per cent., and 6-12 months 15·1 per cent. in excess of that of England and Wales.

The death-rate from most causes was over the average. Tuberculous diseases formed an exception, the death-rate from these diseases being 6·4 per cent. below that of England and Wales. The degree of excess under other headings was as follows:—

Measles + 47·4 per cent., whooping cough + 20·0 per cent., Diarrhœal diseases + 7·0 per cent., premature birth + 4·5 per cent., congenital defects + 4·5 per cent., atrophy, debility, and marasmus + 10 per cent., convulsions + 21·3 per cent., bronchitis and pneumonia + 14·7 per cent.

At ages 1-5 the death-rate was 12·8 per cent. in excess of that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were the following:—

Rural Districts.—Barnsley 167 (births 120); Rotherham 158 (births 996); Hemsworth 157 (births 1,180); Pontefract 146 (births 508); Goole 144 (births 208); Wakefield 144 (births 494).

Urban Districts.—Featherstone 208 (births 585); Monk Bretton 204 (births 162); Royston 201 (births 234); Bolton-on-Dearne 201 (births 329); Rawmarsh 197 (births 624); Drighlington 192 (births 94; Whitwood 187 (births 228); Wombwell 185 (births 633); Normanton 183 (births 508); Ossett 182 (births 319); Soothill Nether 179 (births 106); Shelley 178 (births 45); Castleford 177 (births 803).

The death-rate in each of the *County Boroughs* was as follows:—

Halifax 102 (average rate 1898-1907, 132).
Huddersfield 112 (average rate 1898-1907, 131).
Leeds 138 (average rate 1898-1907, 164).
Sheffield 141 (average rate 1898-1907, 175).
Bradford 143 (average rate 1898-1907, 155).
Rotherham 149 (average rate 1898-1907, 159).

Premature Births and Environment of Pregnant Women.—Dr. Weatherbe in his report on *Rotherham* rural district, writes:—

A large number of the deaths from premature births and congenital defects may be accounted for by the unsuitable surroundings of pregnant women in the poorer districts, where improper food, alcohol, and hard work play an important part.

Dr. Broughton, at *Heckmondwike*:—

has made inquiries, and finds that several of the parents were insufficiently fed owing to bad trade.

Premature Births and Work during Pregnancy.—Dr. Townsley, reporting on *Ardsley*, writes:—

As the majority of the mothers in the township belong to the working classes, and as a consequence have to perform the whole of their household duties without assistance up to the time of their confinement, it is almost to be expected that a certain number of premature births would occur. In a colliery district the amount of household washing is greater than in other districts, and as the work is exceeding laborious, entailing the lifting of heavy washtubs and laborious mangling of clothes, it is hardly to be wondered at that such occasions are often the cause of premature labour.

Privy Middens and Infant Mortality.—Dr. Hillman (*Whitwood*) writes:—

The more I consider the matter, the more I am convinced that the presence of privy-middens, containing all sorts of abominations in the immediate vicinity of the houses of the people is one of the chief causes of the prevalence of this disease. Until some measure is adopted for the immediate removal of sewage from the backdoors of dwelling-houses I shall feel very hopeless in regard to the desired reduction in the number of cases of infantile diarrhœa.

Dr. Burman (*Bolton-on-Dearne*) classifies the needs of his district in respect to sanitary arrangements as follows:—

1. More w.c.'s, either flush or slop, and fewer middens, so that the soil can be carried away from the houses and yards.
2. A type of w.c. which, when properly used, cannot get out of order, and which, if it does get out of order, has mechanism which can easily be got at.
3. More paved yards; for I notice that the better a yard is paved, the cleaner the houses and yards are kept.

Premature Births and Industrial Conditions.—Dr. Clements, the medical officer of health of *Batley,* remarks that the large number of deaths from premature birth:—

are probably an expression of the conditions under which the expectant mother lives. If the expectant mother is not properly nourished, or if she has to go out to work in the mill during the few months that precede or follow her confinement, it will certainly be reflected in the vitality of her offspring and in the occurrence of premature birth.

It is abundantly evident from the excessive prevalence in industrial centres of rickets and other diseases of disturbed nutrition that there is something associated with factory and workshop labour which has a very injurious effect on the children; whether these influences are ante-natal or post-natal, and whether they act entirely through one parent, it is difficult at present to say.

There are certain conditions which are obviously wrong and ought to be corrected; for instance, a married woman should be prevented from working in the mill for the few months preceding child-birth, and during the whole period she is suckling her infant.

That work in the factory both before and after child-birth is a factor of considerable importance in causing our high infantile rate there can be little doubt; at the 1901 census no less than 21·4 per cent. of the married women went out to work in the mills, and this figure probably under-estimates the proportion of married women at child-bearing ages who go out to work.

Privy Middens and Infant Mortality.—In 4,655 houses in Batley dry methods and in 2,041 houses water-carriage methods of disposal of excremental matter are practised. Of the former 1,335 are privies, the rest being ash privies and pail closets.

The "middens" are emptied once a month, the contents being thrown out on the surface of the yard, paved or unpaved, and loaded in carts covered with a waterproof sheet.

The dangers to health of ash-middens and privy-middens have been already referred to, and need not be repeated. The work of converting the middens to water-closets is progressing steadily, but even at the present rate of progress it will be a number of years before they are completely abolished.

Lancashire.

During 1908 the infant death-rate was 130·6 in the administrative county, or 8·5 per cent. in excess of that of England and Wales. In the urban districts it was 135·3, in the rural districts 97·0. In the county boroughs it was 147·8.

At ages under one week, the administrative county had a death-rate 6·2 per cent. in excess, under 1 month 5·5 per cent., under 3 months 6·2 per cent., 3-6 months 12·7 per cent., 6-12 months 9·9 per cent. in excess of that for the whole country.

Under the following headings the death-rate was above the average: diarrhœal diseases 14·1 per cent., premature birth 5·0 per cent., atrophy, debility and marasmus 10 per cent., tuberculous diseases 31·9 per cent. From congenital defects the death-rate was 6·0 per cent., and from convulsions 16·6 per cent. below the average.

At ages 1-5, the death-rate was 13·6 per cent. above the average for the whole of England and Wales.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Leigh 136 (births 294); Limehurst 134 (births 284); Burnley 115 (births 427).

Urban Districts.—Orrell 222 (births 176); Hurst 216 (births 208); Skelmersdale 205 (births 215); Leyland 203 (births 153);

Poulton-le-Fylde 200 (births 50); Kearsley 189 (births 228); Lees 189 (births 122); Audenshaw 185 (births 189); Kirkham 185 (births 92); Whitworth 184 (births 179); Ashton-under-Lyne 183 (average rate 1903-7, 172); Ince-in-Makerfield 183 (average rate 1904-7, 196), Preesall-with-Hackinsall 171 (births 41); Droylsden 171 (births 352).

The infant death-rate in each of the *county boroughs* was as follows:—

Southport 104.
Barrow-in-Furness 111 (138 in 1898-1907).
St. Helens 122 (164 in 1898-1907).
Bury 129 (161 in 1898-1907).
Warrington 134 (160 in 1898-1907).
Blackpool 137.
Liverpool 142 (174 in 1898-1907).
Bootle 144 (170 in 1898-1907).
Bolton 148 (160 in 1898-1907).
Blackburn 149 (177 in 1898-1907).
Manchester 152 (177 in 1898-1907).
Salford 153 (180 in 1898-1907).
Wigan 154 (167 in 1898-1907).
Preston 156 (198 in 1898-1907).
Oldham 159 (162 in 1898-1907).
Burnley 202 (206 in 1898-1907).

Dr. Sergeant in his annual report (County Council, 1908) states that:—

Eighty-eight urban districts have supplied the following information respecting closet accommodation:—

Number of privy middens	52,822
„ pail closets	51,662
„ fresh-water closets	98,109
„ waste-water closets	63,871

Conversions from privy middens have taken place during the year as below:—

Privies converted to water-closets	3,695
„ „ pail closets	120
Pails converted to water-closets	77

Audenshaw.—Dr. Allkin in his annual report for 1908 states that this urban district with a population of 7,749 had still—

1,000 privy middens, only 28 being converted during the year. He adds:—"it is highly necessary for the sanitary welfare of the district that the privy midden be abolished as soon as possible."

Kearsley.—The infant death-rate was 192, as against 180, mean of 1898-1907. Dr. Eames, the medical officer of health, says:—

The chief causes are no doubt improper feeding, want of cleanliness, mothers working too near confinements and too soon after, but I think a comparison of the last two years shows that the greatest factor is a high temperature in the autumn.

Complaints of neglect in emptying ashpits are numerous in this district, and there is great need for the abolition of privy middens.

Cleanliness, &c.—Dr. Whealdon (*Middleton Borough*) says:—

Unhappily, the prejudice of a number of mothers against the most elementary ideas of cleanliness, both as regards the child itself and also the feeding utensils,

is almost unsurmountable, and the extent of almost criminal neglect which has come to light since the work commenced is very serious. Ignorance and poverty can be combated in time; but alcoholism, general fecklessness, and absence of the maternal instinct are much more difficult to deal with.

Dr. Barker, the medical officer of health of *Clitheroe* urban district, in his annual report for 1909 refers to the low infant mortality of 83 as compared with the average for 1899-1908 of 130, and makes the following remarks on *The Relation of Industrial Employment of Married Women* to excessive infant mortality:—

I am pretty confident that two factors have been at work during the past 12 months which have influenced favourably the infantile mortality in Clitheroe, and I shall be much surprised if the truth of this surmise is not reflected in a diminished rate of infantile mortality throughout the whole of the manufacturing districts of Lancashire. I allude to the cool, wet summer, and the scarcity of employment. Two of the largest items which go to swell the totals in infantile mortality returns are the deaths from premature births and diarrhœal diseases, the latter arising from the artificial feeding of infants.

Beyond question employment up to a late period in the mills spells liability to premature labour, and I am inclined, too, to think that work in the mills increases the liability to difficult labour from abnormal presentations, &c. When work and wages are good, women are tempted to stay up to the last possible moment in the factories, and the result is a considerable percentage of premature births. During 1909 these births in Clitheroe numbered only two, against seven in 1908, and nine in 1907.

Again, when trade is good, mothers are anxious to get back to work shortly after confinement, and the infants are put out to nurse. This, of course, entails artificial feeding with its inevitable train of deaths from diarrhœal diseases, the danger being considerably enhanced during hot, dry weather, and possibly too, when the artificial food is prepared by someone other than the actual mother of the child. In 1909 the infantile deaths from diarrhœal diseases numbered only four, against an average of seven for the previous four years.

It may come as a somewhat revolutionary suggestion, but I believe that the operative classes of Lancashire would be better off in the truest sense of the word if the employment in the factories of married women with children were prohibited, nor do I think that they would suffer much financially from such prohibition.

The county borough of *Burnley* in 1908 had an infant mortality of 201 per 1,000 births, the average rate for 1898-1907 having been 206. Dr. Holt, in commenting on this high death-rate, says:—

This state of affairs is in large measure due to the fact that so many of the mothers are occupied in work outside their own home (as) is well shown in looking over the paragraphs relating to the special diseases from which the children have died.

He adds that:—

Of the 155 children who died (from diarrhœa) no less than 147 were fed by the bottle. Again, 97 mothers of the 155 children were working at the time of the child's illness. Of eight children who died who were stated to have been breast-fed, two were children who had been ill from birth, and three lived in very dirty homes. These figures show clearly that the feeding and thence in a direct manner the nursing of a child are the main factors.

Sanitary Circumstances.—There are 532 privies, 2,433 trough closets, 17,133 waste water closets and 6,840 clean water closets in the town. Also 19,244 ashpits and only 2,989 ashbins. Refuse is partially disposed of "at tips in various parts of the town."

Early in the year the health committee visited a large number of manure middens which were in close proximity to dwellings, and orders were made that

these be emptied at regular intervals. In no case was a period allowed of more than a week. Many notices also were served at this time for the proper construction and repair of manure pits generally.

Housing.—Of the total 23,002 houses, 1,955 or nearly 9 per cent. are back to back.

The medical officer of health of *Gorton* (recently added to the City of Manchester) in his report for 1908 reports an infant death-rate of 163, the average rate for 1897-1906 having been 194. He writes as follows on the question of *Privy Middens*:—

There is no getting over the fact that privy middens in towns and urban districts are a national danger. They are not only the chief causes, but almost the sole cause, of the annual epidemic of summer diarrhœa, carrying off by death from this disease, on an average, 20,000 children per annum in the United Kingdom, and also greatly swelling the annual death-roll from typhoid fever.

With this knowledge and absolute proof, year by year, of the terrible effects of these abominable insanitary closets upon the death-rate and sickness of the community, such abominations ought not to be allowed to be erected in any town or urban district.

It stands to the credit of the Gorton Council that since I pointed out the great dangers arising from the privy-midden system, all new houses erected since then have been supplied by water-closets; and whereas at that period there were not a score of houses in the district on that system, there are now more houses supplied with water-closets than remain with the old type, yet the population exceeds 40,000.

It is sheer hypocrisy for our City fathers and others in responsible positions to call out and make much ado about the terrible infantile mortality of the nation, and at the same time blink at the main cause, which adds 20,000 infantile deaths to the slaughter.

Those in power possess the power to so alter or modify the present laws and bye-laws relating to property owners as to quickly remedy the chief cause of summer diarrhœa, which has an immense influence on the infantile mortality of the country.

If the dangers and mortality from such conditions affecting life as phosphorus, arsenic, lead, &c., invoke special legislation in order to minimise the dangers arising from them, other conditions affecting the lives of millions, and a mortality exceeding by many thousands those resulting from the above-mentioned, ought also to bring about the necessary legislation for the suppression of such conditions which are dangerous and inimical to the public health.

Denbighshire.

During 1908 the infant death-rate in the administrative county was 126·7, 5·2 per cent. in excess of that of England and Wales. In the urban parts of the county the death-rate was 127·4; in the rural parts 126·4. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 20·6 per cent. in excess, under 1 month 15·1 per cent., under 3 months 12·9 per cent., and at 3-6 months 16·1 per cent. in excess of that of England and Wales. At ages 6-12 months the death-rate was 17·9 per cent. below that of the country as a whole.

The death-rate from whooping cough was 166 per cent., from atrophy, debility, and marasmus 4·1 per cent., from tuberculous diseases 31·9 per cent., and from convulsions 43·5 per cent. in excess; and from measles 100 per cent., from diarrhœal diseases 45·2 per cent., from premature birth 10·1 per cent., from congenital defects 14·9 per cent., and from bronchitis and pneumonia 0·5 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 14·8 per cent. below the average for the country.

The rural and urban districts having the highest infant death-rates in 1908 were the following:—

Rural Districts.—Llangollen 143 (births 105); Wrexham 136 (births 1,909); Llanrwst 120 (births 100); Ruthin 117 (births 180).

Urban Districts.—Wrexham 153 (births 476); Abergele and Pensarn 150 (births 40); Colwyn Bay and Colwyn 118 (births 194).

Cumberland.

During 1908 the infant death-rate in the administrative county was 126·6, 5·1 per cent. in excess of that of England and Wales. In the urban parts of the county the death-rate was 135·0, in the rural parts 109·4. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 20·6 per cent. in excess, under 1 month 12·7 per cent., under 3 months 7·8 per cent., and 3-6 months 6·7 per cent. in excess of that of England and Wales. At ages 6-12 months the death-rate equalled the average rate for the whole country.

The death-rate from whooping cough was 68·0 per cent., from atrophy, debility, and marasmus 38 per cent., from tuberculous diseases 57·4 per cent., and from bronchitis and pneumonia 15·2 per cent. in excess of the average rate; while the death-rate from measles was 94·7 per cent., from diarrhœal diseases 52·8 per cent., from premature birth 11·1 per cent., from congenital defects 20·9 per cent., and from convulsions 5·7 per cent. below the average rate for the whole country.

At ages 1-5 the death-rate was 12·2 per cent. below the average for England and Wales.

The rural and urban districts having the highest infant death-rates in 1908 were the following:—

Rural Districts.—Cockermouth 172 (births 603); Brampton 103 (births 174).

Urban Districts.—Maryport 140 (births 364); Whitehaven 144 (births 603); Penrith 154 (births 215); Cockermouth 160 (births 131); Workington 170 (average rate 1903-7, 151).

Carnarvonshire.

During 1908, the infant death-rate in the administrative county was 121·1, 0·6 per cent. above that of England and Wales. In the urban parts of the county the infant death-rate was 133·0, in the rural parts 109·6. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 8·2 per cent., under 1 month 0·7 per cent., and under 3 months 18·9 per cent. in excess of, and 3-6 months 3·4 per cent., and 6-12 months 33 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: Congenital defects + 14·9 per cent., convulsions + 162·1 per cent. From measles the death-rate was 78·9 per cent., diarrhœal diseases 66·8 per cent., premature birth 10·6 per cent., atrophy, debility, and marasmus 25·3 per cent., tuberculous diseases 17·0 per cent., and bronchitis and pneumonia 16·7 per cent. below the average. From whooping cough, the death-rate equalled the average rate for the whole country.

At ages 1-5 the death-rate was 25 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Glaslyn 209 (births 67); Geirionydd 123 (births 81); Gwyrfai 115 (births 651).

Urban Districts.—Pwllheli 236 (births 89); Carnarvon 176 (births 216); Conway 172 (births 98); Ynyscynhaiarn 163 (births 98); Bangor 128 (births 243).

Derbyshire.

During 1908 the infant death-rate in the administrative county was 120·4, the average for the whole country. In the urban parts of the county the death-rate was 120·2, in the rural parts 120·6. In the county borough it was 108·1.

At ages under 1 week the administrative county had a death-rate 7·0 per cent. in excess of, at ages under 3 months 0·2 per cent. below, 3-6 months 2·1 per cent. below, and 6-12 months 1·9 per cent. in excess of that of the country as a whole.

The death-rate from premature birth was 3·0 per cent., from atrophy, debility, and marasmus 17·3 per cent., from tuberculous diseases 21·3 per cent., from convulsions 3·7 per cent., and from bronchitis and pneumonia 17·7 per cent. in excess; from measles it was 36·8 per cent., whooping cough 36·0 per cent., diarrhœal diseases 17·6 per cent., and from congenital defects 11·9 per cent. below that of England and Wales.

At ages 1-5, the death-rate was 16·4 per cent. below the average for the country.

The rural and urban districts having the highest infant death-rates in 1908 were the following:—

Rural Districts.—Clown 150 (births 632); Blackwell 150 (births 1,415); Chesterfield 142 (births 2,820).

Urban Districts.—Wirksworth 275 (births 80); South Derby 235 (births 17); Glossop 167 (average rate 1904-07, 145); Chesterfield 151 (births 909); Ilkeston 147 (average rate 1903-07, 173); Dronfield 146 (births 144).

In the *county borough*, Derby, the infant death-rate was 108, the average rate for 1898-1907 having been 144.

Nottinghamshire.

During 1908 the infant death-rate in the administrative county was 119·8 or 0·5 per cent. below that of England and Wales. In the urban districts it was 127·6, in the rural districts 104·7. In the county borough it was 145·8.

At ages under 1 week the administrative county had a death-rate 5·4 per cent., at ages under 1 month 6·7 per cent., at ages under 3 months 2·6 per cent., at ages 3-6 months 1·3 per cent. above, and at ages 6-12 months 8·0 per cent. below the average for the country as a whole.

The death-rate from premature birth was 2·0 per cent., from atrophy, debility, and marasmus 22·7 per cent., from tuberculous diseases 10·6 per cent., from convulsions 24·1 per cent., and from

bronchitis and pneumonia 1·5 per cent. in excess; from measles it was 52·6 per cent., whooping cough 10·0 per cent., diarrhœal diseases 24·1 per cent., and from congenital defects 17·9 per cent. below that of England and Wales.

At ages 1-5 the death-rate was 23·5 per cent. below the average for the country.

The rural and urban districts having the highest infant death-rates were the following:—

Rural Districts.—Skegby 170 (births 224); Basford 121 (births 1,236).

Urban Districts.—Arnold 172 (births 332); Sutton-in-Ashfield 171 (births 702); Huthwaite 159 (births 176); Mansfield Woodhouse 142 (births 401); Kirby-in-Ashfield 140 (births 543).

In the *county borough*, Nottingham, the infant death-rate was 146, the average rate for 1898-1907 having been 177.

The Public Conscience and Infant Mortality.—Dr. Handford, county medical officer of health of Nottingham, remarks:—

> The weather, although a contributing cause, cannot be considered the sole reason for the infantile mortality rate of 1908 being the lowest known in this county. There has been a gradual and continuous drop for many years, but a sudden drop since the year 1905, when the public conscience first became aroused by an acute and serious agitation, as shown by the Infantile Mortality Conferences of 1906 and 1908.

Yorkshire, North Riding.

During 1908 the infant death-rate in the administrative county was 115·1, 4·4 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 125·5, in the rural parts 98·4. In the county borough it was 158·3.

At ages under one week the administrative county had a death-rate 15·2 per cent., under 1 month 9·2 per cent., and under 3 months 0·6 per cent. in excess of, and from 3-6 months 8·5 per cent., and 6-12 months 11·4 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: premature birth + 11·2 per cent., and atrophy, debility, and marasmus + 22·7 per cent. From whooping cough the death-rate was 18·0 per cent., diarrhœal diseases 16·6 per cent., congenital defects 16·4 per cent., tuberculous diseases 17·0 per cent., convulsions 5·6 per cent., and bronchitis and pneumonia 24·0 per cent. below the average. There were no deaths from measles.

At ages 1-5 the death-rate was 4·2 per cent. in excess of that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—Pickering 152 (births 165); Whitby 144 (births 181); Startforth 142 (births 106).

Urban Districts.—Ormesby 174 (births 568); Pickering 163 (births 86); South Bank in Normanby 156 (births 495); Guisborough 153 (births 248); Thornaby-on-Tees 146 (births 629).

The infant death-rate in the county borough of Middlesbrough was 158 (average rate 1898-1907, 180).

Cheshire.

During 1908 the infant death-rate in the administrative county was 113·7, 5·6 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 125·1, in the rural parts 81·2. In the county boroughs it was 147·5.

At ages under one week the administrative county had a death-rate 5·4 per cent., under 1 month 5·7 per cent., and under 3 months 6·7 per cent. below, from 3-6 months 3·4 per cent. in excess of, and 6-12 months 9·9 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: measles + 42·1 per cent., whooping cough + 4·0 per cent., atrophy, debility, and marasmus + 11·3 per cent., tuberculous diseases + 19·2 per cent., and convulsions + 4·6 per cent. From diarrhœal diseases the death-rate was 24·6 per cent., premature birth 3·0 per cent., congenital defects 26·9 per cent., and bronchitis and pneumonia 8·8 per cent. below the average.

At ages 1-5 the death-rate was 4·1 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—Northwich 116 (births 562); Malpas 105 (births 124).

Urban Districts.—Stalybridge 219 (201 in 1903-7); Dukinfield 214 (births 513); Middlewich 182 (births 143); Hyde 169 (180 in 1903-7); Buglawton 167 (births 36); Northwich 157 (births 475); Winsford 156 (births 276); Altrincham 149 (births 457).

The infant death-rate in each of the county boroughs was as follows:—Birkenhead 137 (average rate 1898-1907, 159); Chester 120; Stockport 171 (average rate 1898-1907, 193).

Dukinfield municipal borough in 1908 had an infant death-rate of 214. In 1901 the rate was 275 per 1,000 births. The county medical officer of health states that though Dukinfield is a manufacturing town, a part of it is distinctly rural. The house accommodation is said to be good, and scavenging said to be efficient. There are 4,674 houses. The number of slop closets is 1,110. There are also some water closets, ashpit privies and pails. The night soil from the ashpits is tipped on the sewage farm. The high infant mortality in this district requires further investigation.

Hyde municipal borough had an infant mortality of 169 in 1908. In previous years the enormous rates of 235, 240, 233, and 256 had been recorded.

During 1908 eleven closets were converted from the privy midden system.

Dr. Marsh, the medical officer of health of Macclesfield, writes as follows:—

> Prematurity and atrophy together constitute more than 30 per cent. of the total deaths under one year of age.
>
> I think we ought to make more enquiry into these deaths, since the large numbers involved are a serious reflection on the district.
>
> We ought to enquire into the conditions of motherhood, in these cases, special attention being paid to the (*a*) physique and health of the mother; (*b*) her past history in respect of miscarriage, abortion or premature birth;

(*c*) her general environment, poverty, and feeding; (*d*) hard work during pregnancy. The employment of women at mills and factories during the latter months of pregnancy is, I am convinced, responsible for some of this loss of child life.

In the same report Dr. Marsh gives the following table to which I have added the column of infant death-rates, and makes the remarks which follow:—

The following table, taken from the last Census Report, showing the number of married women engaged in occupations, is of interest:—

—	Total.	Females over 10 in Occupation, Married or Widowed.	Proportion per cent. of Married or Widowed in Occupation.	Infant Mortality.
Crewe	2,994	468	15·6	103
Dukinfield	3,421	833	27·2	214
Congleton	2,196	582	26·8	129
Stalybridge	6,087	1,777	29·1	219
Hyde	7,005	2,150	30·6	169
Macclesfield	8,398	2,629	31·3	127

I showed last year that we had the highest death-rate from prematurity of any of the non-county boroughs in Cheshire, and I think the deduction is quite justified and sound, that there is a causal connection between the two, the high employment rate accounting to a large extent for the high death-rate from prematurity.

As regards the nutrition of the mother before child-birth, this in many cases has left very much to be desired. The necessity of working in the mill, the scanty time left for home work, the deficiency in knowledge of how to buy suitable food, and the consequent purchase of ready-made "tasty dishes," which are excessively dear and contain but little nourishment; these matters are of daily observation, and all go to lower the strength of the prospective mother and undermine the framework of the future child.

If women must work in mills and factories it does seem that the community which requires female labour should take every possible means to ensure the pregnant woman receiving adequate food and rest during her pregnancy, and for some period thereafter.

I much regret that the dinners provided by the Ladies' Public Health Society at a small charge for prospective and nursing mothers, had to be discontinued owing to want of funds.

This is most certainly work which is urgently needed if we are wishful to improve the future of our race and nation. We cannot afford to allow feeble, puny babies to be brought into our midst, when we can ensure a strong and healthy type by looking after the health and feeding of the mother before and after the birth of the child.

We must take some steps to check this production of premature and feeble infants, and we must go to the root of the matter, and face the question of how to help the mothers. It is no exaggeration to say that overwork and starvation are responsible for our high death-rate from prematurity, and the public conscience needs arousing on this matter, which is one of national importance and which concerns our town in a very special sense.

A high death-rate from prematurity means that many of the survivors grow up feeble, stunted creatures who soon become a charge on the rates or charities of the town, and are quite incapable of holding their own in the struggle for existence.

The infant death-rate in Macclesfield was 127 in 1908, having been 178 in 1904. During the same period the number of privy closets had declined from 3,397 to 2,334, and the number of

clean water closets had increased from 1,628 to 2,914. Dr. Marsh's remarks on the remaining privy closets are much to the point:—

It is hoped that in the interest of the public health there may be no slackening in the policy of ridding the town of the remaining privy-middens. There are still many very foul ones in poor quarters of the town, where the conditions of life press heavily enough without the additional daily burden of close company with a stinking mass of putretying filth, the periodical emptyings of which spread the savour broadcast and poison the surface of the ground for yards around; whilst the shoutings of the scavengers and the rattle of the carts and barrows make the night hideous with sounds and stenches.

So likewise are his remarks on *insanitary backyards*:—

The question of insanitary backyards is almost of equal importance with privy-midden conversion. Badly paved or not paved at all, broken flags, pools of sewage and waste water, yard gulleys broken or defective, slopstone pipes discharging into or on the house wall were found in many cases. Again, the tenants in some cases block up the limited space by building rabbit-hutches, hen-pens, kennels, &c., and shut out the small amount of light and air which ought to gain access to the back of the house. This is a most important matter, and it is to be hoped that the sanitary authority will insist on the yards being properly paved and drained, and the removal of all erections which interfere with the free circulation of air at the back of dwelling-houses.

Stalybridge municipal borough in 1908 had an infant death-rate of 219, as compared with 213 for the previous ten years.

The town had 6,692 houses, there being 2,135 privies, 119 pails 1,395 waste water closets and 1,238 trough water closets. During 1908, 131 privies were converted into water closets.

Bronchitis and Pneumonia.— Dr. A. E. Thomas, then medical officer of health of Chester, says:—

It is not suggested that healthy infants should be kept indoors; on the contrary, they should always be taken out on suitable days; but there is no doubt that many infants fall ill of pneumonia or bronchitis by being carried through the streets in the cold and wet or at night, or by accompanying their mothers in inclement weather on holiday excursions or to places of entertainment. If mothers, when called upon to choose between their own amusement and the welfare of their children, invariably took the proper course and stayed at home, deaths of infants from pneumonia and bronchitis would diminish.

A low standard of air purity within the house favours the occurrence of respiratory disease. It is therefore of the highest importance that efficient ventilation should prevail in houses where there are young children, and especially in rooms where they sleep. But this can never be effected in back-to-back houses, or narrow courts and entries. Matters are worse if windows are small and open with difficulty, and the evil is if possible greater still in the presence of dirt and overcrowding.

So long as such housing conditions continue in our midst, the children will continue to suffer.

Poverty and Cleanliness.—Dr. Corbin, medical officer of health of Stockport, remarks:—

Though it is almost impossible for women who return home after working in a factory to do the household work which is necessary to maintain the cleanliness and comfort of the home, yet in many of these cases their homes are better looked after than in a large number of those of women who may be classed with the unemployable, and who will neither work nor look after their children and home. It is among these—the lowest grade—that the greatest mortality occurs, which raises the infantile death-rate.

Poverty, though an important factor, is by no means the only one which determines the condition of comfort and cleanliness of the home, and to one who visits these homes it is at once evident that families living under identical conditions as regards housing and income, exhibit the greatest difference in their living conditions and the success with which they bring up their children. Character and education determine more than poverty these conditions.

It is clear that the Town Council have not given the encouragement to domestic cleanliness which should be supplied by a cleanly system of municipal sanitation for there are still about 8,300 privy ashpits or privies in the town (number of inhabited houses 24,583).

Dr. Corbin states:—

That the mediæval privy midden, suitable though under certain circumstances it may be in a remote and thinly-populated rural district, should exist still in a large and densely-populated manufacturing town, is in itself a strong indication that very much has yet to be done in ordinary sanitation towards attaining the best conditions for the health of the people.

The department is steadily progressing in the work of abolition of these blots on town sanitation. Four hundred and twenty privies have been converted into water-closets during the year.

I have strongly urged that when a conversion is carried out the midden should be abolished and galvanised iron dust-bins, with a suitable cover, should be substituted. To convert the privy into a water-closet and to leave the midden, even in a modified condition to be used as a so-called dry ashpit, is in many cases to leave the matter in *statu quo* as far as improvement in sanitation is concerned. These ashpits are used for all kinds of wet as well as dry refuse, and are often as great a nuisance and as dangerous to health as they were before the conversion. The proximity of such pits of filth to dwelling-houses is fraught with the greatest danger to the occupants, especially infants, both directly and by food contamination, through the agency of flies. One often sees a cat feeding from refuse which has been thrown into these middens and immediately going into one of the dwellings, where it is fondled by the children.

Leicestershire.

During 1908 the infant death-rate in the administrative county was 113·1, 6·1 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 135·8, in the rural parts 96·6. In the county borough it was 129·8.

At ages under one week the administrative county had a death-rate 16·5 per cent., under 1 month 9·2 per cent., and under 3 months 1·9 per cent. in excess of, and 3-6 months 5·5 per cent., and 6-12 months 22·2 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: whooping cough + 12 per cent., premature birth 23·6 per cent., atrophy, debility, and marasmus 44·7 per cent. From measles the death-rate was 47·4 per cent., diarrhœal diseases 45·7 per cent., congenital defects 28·4 per cent., tuberculous diseases 31·9 per cent., convulsions 7·4 per cent., and bronchitis and pneumonia 22·1 per cent. below the average.

At ages 1-5 the death-rate was 33·0 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Loughborough 153 (births 118); Lutterworth 118 (births 227).

Urban Districts.—Hinckley 185 (births 341); Coalville 169 (births 562); Shepshed 136 (births 140); Quorndon 133 (births 45); Melton Mowbray 133 (births 255).

The infant death-rate in the county borough of Leicester was 130 (average rate 1898-1907, 166).

Lincolnshire.

During 1908 the infant death-rate in the administrative county was 106·3, 11·7 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 120·8, in the rural parts 95·3. In the county boroughs it was 120·6.

At ages under 1 week the administrative county had a death-rate 6·2 per cent. in excess of, while at ages under 3 months it was 7·8 per cent., 3-6 months 14·4 per cent., and 6-12 months 17·6 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: whooping cough + 42 per cent., premature birth + 9·6 per cent., atrophy, debility, and marasmus + 12·0 per cent., convulsions + 19·4 per cent. From measles the death-rate was 84·2 per cent., diarrhœal diseases 52·3 per cent., congenital defects 10·4 per cent., tuberculous diseases 27·7 per cent., and bronchitis and pneumonia 27·5 per cent. below the average.

At ages 1-5 the death-rate was 40·6 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—East Elloe 147 (births 258); Sibsey 139 (births 72).

Urban Districts.—Market Rasen 180 (births 50); Bourne 174 (births 98); Spalding 167 (births 233); Boston 144 (births 493); Alford 138 (births 58).

The infant death-rate in each of the county boroughs was as follows:—Grimsby 136 (average rate 1898-1907, 181); Lincoln 94 (average rate 1903-1907, 141).

Dr. Simpson, medical officer of health of Grimsby, in a special report points out how—

Two groups of causes, namely, those included under the head of Atrophy and Premature Birth, and those due to the various Diarrhœal diseases, were in the main responsible for the unsatisfactory returns which have to be made annually in respect of Infantile Mortality.

In this report also he states the following conclusions:—

1. That a high infantile mortality is a feature common to the majority of our large provincial towns.
2. That those towns having a large proportion of women working in factories generally suffer most severely in this respect.
3. That infantile mortality in this Borough is excessively high, although we do not labour under this disadvantage to any appreciable extent.
4. That the total infantile mortality in Grimsby is largely augmented by the excessive prevalence of diarrhœal diseases.
5. That diarrhœa is a "filth" disease, is infective, and is associated with decomposing organic material, and its incidence coincides with the "swarming" of the house-fly.
6. That dust particles and house-flies probably act as "carriers" of infective material.
7. That accumulations of decomposing organic refuse in the vicinity of dwellings is at all times a menace to health and especially so in the case of infants, and during the hot weather.
8. That our system of dealing with excremental material in this borough is defective and lends itself to the ready conveyance of infective material into the food of infants.

His recommendations are:—

1. The adoption of the Notification of Births Act, 1907.
2. The appointment of a lady health visitor.

3. The training of all elder girls in domestic hygiene, and the "mothering" of the infant.
4. The improvements of our methods of refuse disposal, by the replacement of box closets by w.c.'s.
5. The more frequent removal of all refuse from the vicinity of dwellings especially during the hot weather.

The first two recommendations have been adopted; and the work of conversion of the privy closets to water carriage is stated to be proceeding rapidly.

Yorkshire, East Riding.

During 1908 the infant death-rate in the administrative county was 106·1, 11·7 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 123·8, in the rural parts 95·6. In the county boroughs it was 139·2.

At ages under one week the administrative county had a death-rate 10·7 per cent., and under 1 month 3·7 per cent. in excess of, and under 3 months 4·5 per cent., 3-6 months 25·0 per cent., and 6-12 months 17·0 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: whooping cough + 2 per cent., premature birth + 7·0 per cent., congenital defects + 32·8 per cent. From measles the death-rate was 84·2 per cent., diarrhœal diseases 50·8 per cent., atrophy and debility 16·0 per cent., tuberculous diseases 57·5 per cent., convulsions 45·4 per cent., and bronchitis and pneumonia 18·6 per cent. below the average.

At ages 1-5 the death-rate was 35·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Norton 132 (births 152); Beverley 131 (births 268); Sherburn 117 (births 60).

Urban Districts.—Pocklington 222 (births 63); Cottingham 170 (births 100); Hornsea 167 (births 54); Norton 148 (births 107).

The infant death-rate in each of the county boroughs was as follows:—

Kingston-upon-Hull 149 (average rate 1898-1907, 163); York 104 (average rate 1898-1907, 152).

Cornwall.

During 1908 the infant death-rate in the administrative county was 103·1, 14·4 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 110·3, in the rural parts 97·6. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 14·0 per cent., and under 1 month 2·0 per cent. in excess of, and under 3 months 3·7 per cent., 3-6 months 15·7 per cent., and 6-12 months 34·6 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: whooping cough + 36·0 per cent., premature birth + 7·5 per cent. From measles it was 94·7 per cent., diarrhœal diseases 57·8 per cent., congenital defects 67·2 per cent., atrophy, debility, and marasmus 6·7 per cent., tuberculous diseases 44·7

per cent., convulsions 2·8 per cent., and bronchitis and pneumonia 19·1 per cent. below the average.

At ages 1-5 the death-rate was 43·3 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Camelford 157 (births 108); Redruth 124 (births 485); Bodmin 114 (births 220).

Urban Districts.—Hayle 250 (births 16); St. Austell 244 (births 86); Camborne 145 (births 351); Newquay 145 (births 69); Ludgvan 140 (births 50).

Norfolk.

During 1908 the infant death-rate in the administrative county was 103·0, 14·5 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 105·1, in the rural parts 102·5. In the county boroughs it was 119·8.

At ages under 1 week the administrative county had a death-rate 24·7 per cent., and under 1 month 6·5 per cent. in excess of, and under 3 months 2·6 per cent., 3-6 months 36·4 per cent., and 6-12 months 21·9 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: measles + 79·0 per cent., whooping cough + 102·0 per cent., premature birth + 15·6 per cent., and atrophy, debility, and marasmus + 17·3 per cent. From diarrhœal diseases the death-rate was 82·4 per cent., congenital defects 31·3 per cent., tuberculous diseases 51·1 per cent., convulsions 25·9 per cent., and bronchitis and pneumonia 24·5 per cent. below the average.

At ages 1-5 the death-rate was 39·0 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—King's Lynn 533 (births 15); Marshland 169 (births 308); Forehoe 137 (births 299); Downham 134 (births 258).

Urban Districts.—Cromer 219 (births 64); Swaffham 136 (births 59); Walsoken 132 (births 106); Wells-next-the-Sea 125 (births 64).

The infant death-rate in each of the county boroughs was as follows:—Great Yarmouth 125 (average rate 1898-1907, 170); Norwich 117 (average rate 1898-1907, 160).

Pre-natal Causes of Infant Mortality.—Dr. Pattin (*Norwich*) remarks:—

> I invite attention to the deaths attributed to "Premature Birth," "Congenital Defect," and "Debility," because these suggest, and strongly, the existence of conditions of an unfavourable character which affect the child, through the mother, prior to its birth. And I invite attention to these considerations because it is so commonly assumed that infantile mortality is due almost entirely to imperfect or improper feeding of the child; and, if you include in your definition of the feeding of infants, the nutrition of the mothers, there is a strong case to be made out. Infant mortality cannot be dissociated from *pre-natal* influences, and be regarded as due solely to *post-natal* causes. A considerable proportion of the parents are naturally of enfeebled constitution—some are intemperate drinkers, many are relatively underfed, and others not so much under as unwisely or intemperately fed. Some of the

mothers induce in themselves undesirable conditions of debility, *e.g.*, by working too strenuously during the later stages of pregnancy, or by bearing children too rapidly, &c. In short, we have always to keep in our minds Burke's definition of the community, viz., that it is "a partnership not only between those who are living, but between those who are living and those who are dead, and those who are to be born," and must endeavour rightly to estimate the antecedents to death, and it is in respect of these that *ante-natal* conditions become so important.

He gives the following account of help given to nursing and expectant mothers:—

The aid, in the shape of dinners to ill-nourished expectant mothers, given by the Charity Organisation Society upon my recommendation, has also contributed to the gratifying lessening in this special and most important death-rate. Of the generous assistance given to ill-nourished mothers by the Sick Poor Society, it is impossible for me to speak too warmly, especially as this society has strained its resources to give milk, usually one pint per diem for five weeks, to the mothers recommended. Since midsummer, when the society first took up this work, out of 195 names sent in, 184, or 95 per cent. received assistance, and promptly. The Charity Organisation Society undertook to investigate the circumstances of such badly-nourished expectant mothers as I might recommend, and endeavour to get dinners provided for those it deemed sufficiently deserving. Out of 28 so recommended, it arranged for the provision of some dinners for 14.

Cambridgeshire.

During 1908 the infant death-rate in the administrative county was 102·6, 14·8 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 114·1, in the rural parts 94·5. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 16·9 per cent., and under 1 month 7·2 per cent. in excess of, and under 3 months 3·8 per cent., 3-6 months 36·7 per cent., and 6-12 months 20·4 per cent. below that of England and Wales.

The death-rate from the following diseases was over the average: whooping cough + 86·0 per cent., and atrophy, debility, and marasmus + 32 per cent. From measles the death-rate was 26·3 per cent., diarrhœal diseases 71·3 per cent., premature birth 5·5 per cent., congenital defects 17·9 per cent., tuberculous diseases 12·8 per cent., convulsions 53·7 per cent., and bronchitis and pneumonia 21·6 per cent. below the average.

At ages 1-5 the death-rate was 9·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—Wisbech 130 (births 61); Linton 120 (births 208).

Urban Districts.—March 151 (births 185); Cambridge 145 (births 791); Chatteris 114 (births 140).

Warwickshire.

During 1908 the infant death-rate in the administrative county was 101·8, 15·4 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 105·3, in the rural parts 96·3. In the county boroughs it was 137·5.

At ages under one week the administrative county had a death-rate 14·4 per cent., under 1 month 14·9 per cent., under 3 months

11·6 per cent., 3-6 months 6·8 per cent., and 6-12 months 29·3 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average: measles — 63·2 per cent., whooping cough — 16·0 per cent., diarrhœal diseases — 21·1 per cent., premature birth — 7·5 per cent., congenital defects — 52·2 per cent., atrophy, debility, and marasmus — 10·0 per cent., tuberculous diseases — 23·4 per cent., convulsions — 19·4 per cent., and bronchitis and pneumonia — 24·5 per cent.

At ages 1-5 the death-rate was 25·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Nuneaton 169 (births 71); Foleshill 134 (births 740); Atherstone 126 (births 596).

Urban Districts.—Aston Manor 132 (average 1898-1907, 165); Stratford-on-Avon 122 (births 188); Warwick 121 (births 290); Kenilworth 111 (births 99).

The infant death-rate in each county borough was as follows: Birmingham 145 (average rate 1898-1907, 175); Coventry 92 (average rate 1898-1907, 136).

Shropshire.

During 1908 the infant death-rate in the administrative county was 100·1, 16·9 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 113·5, in the rural parts 88·7. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 9·1 per cent. above, under 1 month 1·2 per cent., under 3 months 8·4 per cent., 3-6 months 22·5 per cent., 6-12 months 29·6 per cent. below that of England and Wales.

The death-rate from the following diseases was above the average: atrophy, debility, and marasmus + 4·0 per cent., bronchitis and pneumonia + 8·3 per cent. The death-rate from whooping cough was 22·0 per cent., from diarrhœal diseases 59·8 per cent., premature birth 1·0 per cent., congenital defects 26·9 per cent., tuberculous diseases 38·3 per cent., and convulsions 7·4 per cent. below the average for England and Wales. There were no deaths from measles.

At ages 1-5 the death-rate was 29·5 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Burford 192 (26 births); Teme 167 (36 births); Newport 133 (135 births).

Urban Districts.—Dawley 147 (231 births); Bridgnorth 145 (117 births); Ellesmere 140 (43 births); Oakengates 128 (375 births).

Worcestershire.

During 1908 the infant death-rate in the administrative county was 99·1, 17·7 per cent. below that of England and Wales. In

the urban parts of the county the infant death-rate was 101·1, in the rural parts 96·6. In the county boroughs it was 129·4.

At ages under 1 week the administrative county had a death-rate 1·2 per cent. above, under 1 month 4·2 per cent. below, under 3 months 11·0 per cent., 3-6 months 11·0 per cent., and 6-12 months 35·8 per cent. below that of England and Wales.

The death-rate from atrophy, debility, and marasmus was 18·7 per cent. above the average. From measles it was 84·2 per cent., whooping cough 38·0 per cent., diarrhœal diseases 39·7 per cent., premature birth 2·0 per cent., congenital defects 32·8 per cent., tuberculous diseases 14·9 per cent., convulsions 48·2 per cent., and bronchitis and pneumonia 30·4 per cent. below the average.

At ages 1-5 the death-rate was 28·3 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—Halesowen 128 (births 800); Shipston-on-Stour 104 (births 115).

Urban Districts.—Oldbury 147 (births 147); Kidderminster 121 (births 522); Bromsgrove 120 (births 241).

The infant death-rate in each of the county boroughs was as follows:—Dudley 142; Worcester 113.

Middlesex.

During 1908 the infant death-rate in the administrative county was 95·2, 20·9 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 94·3, in the rural parts 114·0. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 16·0 per cent., under 1 month 17·9 per cent., under 3 months 20·7 per cent., 3-6 months 17·8 per cent., and 6-12 months 23·8 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average: measles — 15·8 per cent., whooping cough — 46·0 per cent., diarrhœal diseases — 22·1 per cent., premature birth — 12·6 per cent., congenital defects — 19·4 per cent., atrophy, debility, and marasmus — 21·3 per cent., tuberculous diseases — 14·9 per cent., convulsions — 57·4 per cent., and bronchitis and pneumonia — 22·1 per cent.

At ages 1-5 the death-rate was 25·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural District.—Staines 136 (births 601).

Urban Districts.—Hampton Wick 150 (births 40); Greenford 129 (births 31); Feltham 129 (births 155); Brentford 121 (births 464); Acton 120 (births 1,568).

Northamptonshire.

During 1908 the infant death-rate in the administrative county was 94·3, 21·7 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 101·2, in the rural parts 86·2, and in the county borough 96·9.

At ages under 1 week the administrative county had a death-rate 14·0 per cent. and under 1 month 4·5 per cent. in excess, under 3 months 8·9 per cent., 3-6 months 36·4 per cent., 6-12 months 36·4 per cent. below that of England and Wales.

The death-rate from the following diseases was above the average: whooping cough + 64 per cent., premature birth + 21·1 per cent. The death-rate from measles was 52·6 per cent., diarrhœal diseases 66·8 per cent., congenital defects 4·2 per cent., atrophy, debility, and marasmus 21·3 per cent., tuberculous diseases 59·6 per cent., convulsions 40·8 per cent., and bronchitis and pneumonia 25·5 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 43·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Barnack 192 (births 47); Wellingborough 138 (births 282); Hardingstone 120 (births 150).

Urban Districts.—Finedon 172 (births 87); Rothwell 162 (births 99); Daventry 125 (births 64).

In the county borough, Northampton, the rate was 96·9, the average for 1898-1907 being 139.

Bedfordshire.

During 1908 the infant death-rate in the administrative county was 91·2, 24·3 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 100·5, in the rural parts 76·8. There are no county boroughs.

At ages under one week the administrative county had a death-rate 0·4 per cent., under 1 month 6·0 per cent., under 3 months 8·1 per cent., 3-6 months 35·2 per cent., and 6-12 months 48·5 per cent. below that of England and Wales.

The death-rate from premature birth was 22·6 per cent. above the average. From measles it was 89·5 per cent., whooping cough 24·0 per cent., diarrhœal diseases 68·3 per cent., congenital defects 32·8 per cent., atrophy, debility, and marasmus 12·7 per cent., tuberculous diseases 70·2 per cent., convulsions 16·7 per cent., and bronchitis and pneumonia 31·4 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 44·3 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural District.—Biggleswade 94 (births 509).

Urban Districts.—Luton 118 (births 1,292); Ampthill 106 (births 47).

Suffolk.

During 1908, the infant death-rate in the administrative county was 90·9, 24·5 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 95·9, in the rural parts 87·7, and in the county borough 110·7.

At ages under one week, the administrative county had a death-rate 7·4 per cent. above the average, under one month 1·7 per cent., under 3 months 13·4 per cent., 3-6 months 40·3 per cent., 6-12 months 35·2 per cent. below that of England and Wales.

The death-rate from the following diseases was above the average: whooping cough + 10·0 per cent., premature birth + 11·6 per cent., atrophy, debility, and marasmus + 8·0 per cent. The death-rate from measles was 52·6 per cent., diarrhœal diseases 82·4 per cent., congenital defects 31·4 per cent., tuberculous diseases 19·1 per cent., convulsions 25·0 per cent., and bronchitis and pneumonia 34·8 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 44·0 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Hoxne 157 (births 230); Brandon 139 (births 165); Samford 118 (births 281).

Urban Districts.—Haverhill 122 (births 107); Hadleigh 119 (births 67); Felixstowe and Walton 113 (births 160).

In the county borough, Ipswich, the rate was 110·7, the average for 1898-1907 being 147.

Essex.

During 1908 the infant death-rate in the administrative county was 89·3, 25·8 per cent. below that of England and Wales. In the urban parts of the county, the infant death-rate was 92·9, in the rural parts 77·2. In the county borough it was 128·6.

At ages under 1 week, the administrative county had a death-rate 5·8 per cent., under 1 month 6·7 per cent., under 3 months 17·1 per cent., 3-6 months 35·2 per cent., 6-12 months 36·4 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average: measles − 36·8 per cent., whooping cough − 12·0 per cent., diarrhœal diseases − 40·7 per cent., premature birth − 10·1 per cent., congenital defects − 19·4 per cent., atrophy, debility, and marasmus − 8·0 per cent., tuberculous diseases − 21·3 per cent., convulsions − 42·6 per cent., and bronchitis and pneumonia − 32·8 per cent.

At ages 1-5 the death-rate was 28·1 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Bumpstead 135 (births 52); Epping 128 (births 282).

Urban Districts.—Buckhurst Hill 189 (births 106); Halstead 178 (births 101); Harwich 135 (births 326); Wivenhoe 127 (births 63); Waltham Cross 126 (births 159).

In the county borough, West Ham, the death-rate was 128·6, the average for 1898-1907 being 162.

Devonshire.

During 1908 the infant death-rate in the administrative county was 88·2, 26·7 per cent. below that of England and Wales. In

the urban parts of the county, the infant death-rate was 101·9, in the rural parts 74·8, and in the county boroughs, 124·4.

At ages under 1 week, the administrative county had a death-rate 10·7 per cent., under one month 15·9 per cent., under 3 months 22·5 per cent., 3-6 months 29·7 per cent., and 6-12 months 33·0 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average: measles — 26·3 per cent., whooping cough — 16·0 per cent., diarrhœal diseases — 54·8 per cent., premature birth — 18·6 per cent., congenital defects — 28·4 per cent., atrophy, debility, and marasmus — 30·0 per cent., tuberculous diseases — 55·3 per cent., convulsions — 12·0 per cent., and bronchitis and pneumonia — 29·4 per cent.

At ages 1-5 the death-rate was 41·7 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—St. Thomas 110 (births 511); Broadwood-widger 104 (births 48); Bideford 98 (births 122).

Urban Districts.—Seaton 238 (births 21); Dawlish 169 (births 83); East Stonehouse 156 (births 385); Torquay 139 (births 524); Northam 138 (births 138).

The infant death-rate in each of the county boroughs was as follows:—Devonport 117 (average rate 1898-1907, 129); Exeter 127; Plymouth 129 (average rate 1898-1907, 155).

Kent.

During 1908 the infant death-rate in the administrative county was 87·7, 27·2 per cent. below that of England and Wales. In the urban parts of the county, the infant death-rate was 89·4, in the rural parts 83·9. In the county borough it was 114·9.

At ages under 1 week the administrative county had a death-rate 24·3 per cent., under 1 month 20·8 per cent., under 3 months 21·9 per cent., 3-6 months 32·6 per cent., 6-12 months 33·6 per cent. below that of England and Wales.

The death-rate from measles was 47·4 per cent., whooping cough 38·0 per cent., diarrhœal diseases 35·2 per cent., premature birth 21·6 per cent., congenital defects 41·8 per cent., atrophy, debility, and marasmus 18·7 per cent., tuberculous diseases 27·7 per cent., convulsions 45·4 per cent., and from bronchitis and pneumonia 28·4 per cent. below that of England and Wales.

At ages 1-5 the death-rate was 36·9 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Tonbridge 103 (births 397); Isle of Thanet 102 (births 256).

Urban Districts.—Queenborough 158 (births 38); Northfleet 149 (births 390); Chatham 127 (births 1,038); Margate 125 (births 425); Hythe 117 (births 145).

In Canterbury, the county borough, the rate was 115.

Hampshire.

During 1908 the infant death-rate in the administrative county was 83·6, 30·6 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 93·1, in the rural parts 73·6. In the county boroughs it was 102·8.

At ages under 1 week the administrative county had a death-rate 7·8 per cent., under 1 month 10·4 per cent., under 3 months 19·6 per cent., 3-6 months 37·7 per cent., and 6-12 months 47·2 per cent. below that of England and Wales.

The death-rate from whooping cough was 4·0 per cent. above the average. From measles it was 73·7 per cent., from diarrhœal diseases 48·7 per cent., premature birth 5·0 per cent., congenital defects 37·3 per cent., atrophy, debility, and marasmus 21·3 per cent., tuberculous diseases 44·7 per cent., convulsions 54·6 per cent., and bronchitis and pneumonia 34·8 per cent. below the average.

At ages 1-5 the death-rate was 48·9 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Havant 128 (births 109); Hursley 111 (births 81); Fordingbridge 106 (births 141).

Urban Districts.—Farnborough 138 (births 269); Alton 117 (births 145); Gosport and Alverstoke 108 (births 897).

The infant death-rate in each of the county boroughs was as follows:—Bournemouth 95 (average rate 1898-1907, 110); Portsmouth 99 (average rate 1898-1907, 147); Southampton 113 (average rate 1898-1907, 135).

Somersetshire.

During 1908 the infant death-rate in the administrative county was 81·2, 32·6 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 97·0, in the rural parts 71·0, and in the county borough it was 79·3.

At ages under one week the administrative county had a death-rate 0·8 per cent. above, under 1 month 9·4 per cent., under 3 months 23·8 per cent., 3-6 months 45·3 per cent., 6-12 months 40·7 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average for England and Wales: Measles — 68·4 per cent., whooping cough — 54·0 per cent., diarrhœal diseases — 60·3 per cent., premature birth — 21·1 per cent., congenital defects — 19·4 per cent., atrophy, debility, and marasmus — 29·3 per cent., tuberculous diseases — 42·6 per cent., convulsions — 35·2 per cent., and bronchitis and pneumonia — 27·0 per cent.

At ages 1-5 the death-rate was 51·8 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—Keynsham 123 (births 212); Chard 100 (births 310).

Urban Districts.—Crewkerne 146 (births 82); Taunton 133 (births 483); Minehead 123 (births 57).

In Bath, the county borough, the rate was 79·3, the average for 1898-1907 being 100.

Gloucestershire.

During 1908 the infant death-rate in the administrative county was 80·3, 33·3 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 97·8, in the rural parts 72·6. In the county boroughs it was 124·3.

At ages under 1 week the administrative county had a death-rate 5·4 per cent., under 1 month 14·4 per cent., under 3 months 19·6 per cent., 3-6 months 55·1 per cent., and 6-12 months 44·8 per cent. below that of England and Wales.

The death-rates from the following diseases were below the average: measles — 68·4 per cent., whooping cough — 12·0 per cent., diarrhœal diseases — 61·3 per cent., premature birth — 14·1 per cent., congenital defects — 58·2 per cent., atrophy, debility, and marasmus — 22·0 per cent., tuberculous diseases — 40·4 per cent., convulsions — 37·0 per cent., and bronchitis and pneumonia — 30·4 per cent.

At ages 1-5 the death-rate was 52·1 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows: —

Rural Districts.—Marston Sicca 125 (births 32); Pebworth 114 (births 88); West Dean 102 (births 394).

Urban Districts.—Coleford 183 (births 60); Tetbury 135 (births 37); Tewkesbury 129 (births 124); Nailsworth 123 (births 65).

The infant death-rate in each of the county boroughs was as follows: —Bristol 126 (average rate 1898-1907, 132); Gloucester 113.

Sussex.

During 1908 the infant death-rate in the county was 79·8, 33·7 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 86·1, in the rural parts 73·4. In the county boroughs it was 98·0.

At ages under 1 week the county had a death-rate 1·2 per cent. above; under 1 month 11·4 per cent., under 3 months 22·5 per cent., 3-6 months 47·0 per cent., 6-12 months 43·5 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average: —Measles — 89·5 per cent., whooping cough — 38·0 per cent., diarrhœal diseases — 61·3 per cent., premature birth — 0·5 per cent., congenital defects — 46·3 per cent., atrophy, debility, and marasmus — 14·7 per cent. tuberculous diseases — 46·8 per cent., convulsions — 60·2 per cent., and bronchitis and pneumonia — 34·8 per cent.

At ages 1-5 the death-rate was 22·9 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows: —

Rural Districts.—West Steyning 102 (births 205); Battle 97 (births 155); Hastings 97 (births 31).

Urban Districts.—Cuckfield 179 (births 28); Southwick 141 (births 106); Newhaven 120 (births 167); Battle 110 (births 73); Worthing 109 (births 531).

The infant death-rate in each county borough was as follows:—Brighton 104 (average for 1898-1907, 138); Hastings 81 (average for 1898-1907, 117).

Surrey.

During 1908 the infant death-rate in the administrative county was 79·0, 34·4 per cent. below that of England and Wales. In the urban parts of the county, the death-rate was 82·7, in the rural parts 71·8. In the county borough it was 99·1.

At ages under 1 week the administrative county had a death-rate 22·6 per cent., under one month 21·6 per cent., under 3 months 27·5 per cent., 3-6 months 38·1 per cent., 6-12 months 45·4 per cent. below that of England and Wales.

The death-rate from measles was 21·1 per cent., whooping cough 38·0 per cent., diarrhœal diseases 51·3 per cent., premature birth 13·1 per cent., congenital defects 25·4 per cent., atrophy, debility, and marasmus 42·7 per cent., tuberculous diseases 34·0 per cent., convulsions 42·6 per cent., and bronchitis and pneumonia 36·8 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 41·6 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural District.—Croydon 84 (births 1,487).

Urban Districts.—Dorking 144 (births 153); Farnham 123 (births 171); Richmond 106 (births 612).

In the county borough, Croydon, the infant death-rate was 99·1, the average for 1898-1907 being 126.

Buckinghamshire.

During 1908 the infant death-rate in the administrative county was 78·9, 34·5 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 83·3, in the rural parts 76·3. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 3·3 per cent. above, and under 1 month it was 8·2 per cent., under 3 months 21·4 per cent., 3-6 months 50·4 per cent., and 6-12 months 48·8 per cent. below that of England and Wales.

The death-rate from premature birth was 8·5 per cent. above the average. From measles it was 78·9 per cent., whooping cough 18·0 per cent., diarrhœal diseases 70·8 per cent. congenital defects 50·7 per cent., atrophy, debility, and marasmus 52·0 per cent., tuberculous diseases 74·5 per cent., convulsions 33·3 per cent., and bronchitis and pneumonia 40·7 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 52·3 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Newport Pagnell 96 (births 446); Wing 94 (births 117); Eton 91 (births 486).

Urban Districts.—Eton 121 (births 33); Chesham 100 (births 201); Linslade 96 (births 52).

Hertfordshire.

During 1908 the infant death-rate in the administrative county was 78·7, 34·6 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 83·8, in the rural parts 69·9. There are no county boroughs.

At ages under one week, the administrative county had a death-rate 16·5 per cent., under one month 17·6 per cent., under 3 months 25·9 per cent., 3-6 months 45·3 per cent., 6-12 months 44·1 per cent. below that of England and Wales.

The death-rate from measles was 84·2 per cent., whooping cough 24·0 per cent., diarrhœal diseases 64·3 per cent., premature birth 12·1 per cent., congenital defects 35·8 per cent., atrophy, debility, and marasmus 36·7 per cent., tuberculous diseases 21·3 per cent., convulsions 27·8 per cent., and from bronchitis and pneumonia 34·3 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 49·2 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—St. Albans 102 (births 423); Ware 101 (births 199).

Urban Districts.—Hitchin 137 (births 262); Hoddesdon 103 (births 117); Stevenage 103 (births 117); East Barnet Valley 101 (births 268).

Wiltshire.

During 1908 the infant death-rate in the administrative county was 78·0, 26·9 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 94·2, in the rural parts 65·2. There are no county boroughs.

At ages under one week, the administrative county had a death-rate 2·9 per cent., under 1 month 8·9 per cent., under 3 months 22·1 per cent., 3-6 months 44·9 per cent., 6-12 months 54·3 per cent. below that of England and Wales.

The death-rate from measles was 68·4 per cent., whooping cough 24 per cent., diarrhœal diseases 74·9 per cent., premature birth 16·1 per cent., congenital defects 71·7 per cent., atrophy, debility, and marasmus 42·7 per cent., tuberculous diseases 74·5 per cent., convulsions 45·4 per cent., bronchitis and pneumonia 28·4 per cent. below the average for England and Wales.

At ages 1-5 the death-rate was 53·4 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Calne 97 (births 103); Marlborough 93 (births 118).

Urban Districts.—Warminster 118 (births 119); Trowbridge 115 (births 278); Salisbury 109 (average rate from 1905-07, 95).

Dorsetshire.

During 1908 the infant death-rate in the administrative county was 77·7, 35·5 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 88·3, in the rural parts 65·1. There are no county boroughs.

At ages under 1 week, the administrative county had a death rate 11·1 per cent., under 1 month 13·2 per cent., under 3 months 24·7 per cent., 3-6 months 58·1 per cent., and 6-12 months 59·6 per cent. below that of England and Wales.

The death-rate from whooping cough was 26·0 per cent. above the average. From measles the death-rate was 63·2 per cent., diarrhœal diseases 77·4 per cent., premature birth 16·6 per cent., congenital defects 19·4 per cent., atrophy, debility, and marasmus 32·7 per cent., tuberculous diseases 46·8 per cent., convulsions 25·0 per cent., and from bronchitis and pneumonia 38·2 per cent. below the average.

At ages 1-5 the death-rate was 44·3 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Poole 96 (births 134); Weymouth 90 (births 167).

Urban Districts.—Bridport 115 (births 96); Poole 99 (births 880); and Lyme Regis 95 (births 42).

Berkshire.

During 1908 the infant death-rate in the administrative county was 76·7, 36·3 per cent. below that of England and Wales. In the urban parts of the county, the infant death-rate was 79·6, in the rural parts 75·5. In the county borough it was 98·6.

At ages under one week, the administrative county had a death-rate 23·5 per cent., under 1 month 20·4 per cent., under 3 months 28·6 per cent., 3-6 months 48·7 per cent., and 6-12 months 32·4 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average: measles — 89·5 per cent., whooping cough — 58·0 per cent., diarrhœal diseases — 71·9 per cent., premature birth — 2·1 per cent., congenital defects — 3·0 per cent., atrophy, debility, and marasmus — 24·0 per cent., tuberculous diseases — 70·2 per cent., convulsions — 28·7 per cent., and bronchitis and pneumonia — 36·3 per cent.

At ages 1-5 the death-rate was 50·6 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Abingdon 100 (births 200); Wokingham 96 (births 374).

Urban Districts.—Maidenhead 98 (births 357); Wokingham 91 (births 77).

The infant death-rate in the county borough of Reading was 99 (average rate 1898-1907, 128).

Herefordshire.

During 1908 the infant death-rate in the administrative county was 75·8, 37·0 per cent. below that of England and Wales. In the urban parts of the county it was 85·8, in the rural parts 70·2. There are no county boroughs.

At ages under 1 week the administrative county had a death-rate 25·1 per cent., under 1 month 22·6 per cent., under 3 months 32·6 per cent., 3-6 months 29·7 per cent., and 6-12 months 51·2 per cent. below that of England and Wales.

The death-rate from atrophy, debility, and marasmus was 26·7 per cent. above the average. From measles it was 100·0 per cent., whooping cough 60·0 per cent., diarrhœal diseases 71·4 per cent., premature birth 20·6 per cent., congenital defects 76·1 per cent., tuberculous diseases 38·3 per cent., convulsions 36·1 per cent., and bronchitis and pneumonia 30·4 per cent. below the average.

At ages 1-5 the death-rate was 30·2 per cent. below that of the country as a whole.

The rural and urban districts having the highest death-rates in 1908 were as follows:—

Rural Districts.—Wigmore 131 (births 84); Whitchurch 115 (births 26).

Urban Districts.—Bromyard 138 (births 36); Kington 103 (births 39).

Oxfordshire.

During 1908 the infant death-rate in the administrative county was 73·0, 39·4 per cent. below that of England and Wales. In the urban parts of the county the infant death-rate was 77·8, and in the rural parts 70·7. In the county borough it was 94·5.

At ages under 1 week the administrative county had a death-rate 14·0 per cent., under 1 month 24·1 per cent., under 3 months 30·8 per cent., 3-6 months 44·5 per cent., 6-12 months 52·8 per cent. below that of England and Wales.

The death-rate from the following diseases was below the average for England and Wales: whooping cough — 26·0 per cent., diarrhœal diseases — 59·3 per cent., premature birth — 12·1 per cent., congenital defects — 34·3 per cent., atrophy, debility, and marasmus — 46·0 per cent., tuberculous diseases — 66·0 per cent., convulsions — 30·6 per cent., and bronchitis and pneumonia — 46·6 per cent. There were no deaths from measles in the county.

At ages 1-5 the death-rate was 57·3 per cent. below that of the country as a whole.

The rural and urban districts having the highest infant death-rates in 1908 were as follows:—

Rural Districts.—Henley 124 (births 162); Culham 102 (births 49); Headington 92 (births 295).

Urban Districts.—Caversham 100 (births 251); Banbury 97 (births 310); Bicester 91 (births 88).

In Oxford, the county borough, the death-rate was 94·5, the average for 1903-7 being 102.

APPENDIX III.

Table I.

1908.—*Deaths of Infants under 1 year of age per 1,000 Births, and at 1–5 per 1,000 Survivors at the age of one, in the Counties of England and Wales.*

—	Administrative County.		Urban Districts.		Rural Districts.		County Boroughs.	
	0-1.	1-5.	0-1.	1-5.	0-1.	1-5.	0-1.	1-5.
Glamorgan... ...	154·3	77·5	164·8	84·7	124·5	58·0	134·7	52·1
Durham	151·1	75·4	147·2	78·3	155·6	71·7	137·9	85·4
Northumberland ...	147·3	65·1	155·3	72·0	126·8	48·2	139·4	86·6
Monmouth... ...	140·3	59·3	147·0	62·0	91·3	40·6	135·4	60·5
Carmarthen ...	140·1	62·4	129·5	66·2	146·9	60·0	—	—
Stafford	131·7	58·8	139·8	63·5	97·1	39·8	140·0	69·6
Yorks, West Riding	131·6	69·5	134·2	73·4	123·6	57·7	136·8	83·7
Lancashire	130·6	70·0	135·3	74·1	97·0	42·0	147·8	94·6
Brecknockshire ...	128·5	64·2	103·7	67·5	141·9	62·3	—	—
Denbigh	126·7	52·5	127·4	46·8	126·4	54·5	—	—
Cumberland ...	126·6	54·1	135·0	60·5	109·4	41·4	—	—
Carnarvon	121·1	46·2	133·0	47·2	109·6	45·3	—	—
Derby	120·4	51·5	120·2	56·9	120·6	46·0	108·1	53·0
Nottingham ...	119·8	47·1	127·6	50·7	104·7	40·2	145·8	57·4
Yorks, North Riding	115·1	64·2	125·5	80·8	98·4	38·1	158·3	132·7
Cheshire	113·7	59·1	125·1	66·5	81·2	38·9	147·5	89·5
Leicestershire ...	113·1	41·3	135·8	55·4	96·6	31·6	129·8	75·1
Flintshire	107·8	59·6	120·5	72·5	98·1	50·0	—	—
Cardiganshire ...	107·3	37·2	111·8	40·7	105·5	35·8	---	—
Lincolnshire ...	106·3	36·6	120·8	42·7	95·3	32·0	120·6	45·8
Yorks, East Riding	106·1	39·6	123·8	51·4	95·6	32·7	139·2	68·9
Merioneth	104·9	37·5	107·6	38·4	102·9	36·9	—	—
Pembroke	104·4	43·3	123·5	57·7	90·8	33·3	—	—
Westmorland ...	103·6	32·8	110·1	42·1	98·7	23·8	—	—
Cornwall	103·1	34·9	110·3	37·7	97·6	32·8	—	—
Norfolk	103·0	37·0	105·1	50·6	102·5	33·9	119·8	36·0
Cambridge... ...	102·6	55·6	114·1	74·8	94·5	42·3	—	—
Warwick	101·8	45·8	105·3	52·9	96·3	34·5	137·5	74·7
Shropshire	100·1	43·4	113·5	51·3	88·7	36·9	—	—
Anglesey	99·5	44·2	117·9	58·5	88·7	36·1	—	—
Worcestershire ...	99·1	44·2	101·1	46·6	96·6	40·9	129·4	48·6
Radnor	96·0	33·3	60·3	36·7	106·0	32·4	—	—
Middlesex	95·2	45·8	94·3	45·7	114·0	46·4	—	—
Northampton ...	94·3	34·7	101·2	32·4	86·2	37·4	96·9	45·5
Rutland	93·7	31·8	—	—	93·7	31·8	—	—
Bedford	91·2	34·3	100·5	30·9	76·8	39·4	—	—
Suffolk	90·9	34·5	95·9	36·5	87·7	33·3	110·7	60·3
Essex	89·3	44·3	92·9	47·5	77·2	34·1	128·6	87·8
Devonshire ...	88·2	35·9	101·9	43·4	74·8	28·8	124·4	48·5
Kent	87·7	38·9	89·4	39·4	83·9	37·8	114·9	74·4
Huntingdon ...	84·8	32·7	90·4	44·0	81·7	26·5	—	—
Hampshire... ...	83·6	31·5	93·1	37·6	73·6	25·2	102·8	43·2
Somerset	81·2	29·7	97·0	34·6	71·0	26·7	79·3	58·9
Gloucester	80·3	29·5	97·8	34·9	72·6	27·2	124·3	63·1

Table I—*continued.*

—	Administrative County.		Urban Districts.		Rural Districts.		County Boroughs.	
	0-1.	1-5.	0-1.	1-5.	0-1.	1-5.	0-1.	1-5.
Sussex	79·8	47·5	86·1	69·9	73·4	24·7	98·0	52·5
Surrey	79·0	36·0	82·7	37·6	71·8	32·9	99·1	64·9
Buckingham ...	78·9	29·4	83·3	30·9	76·3	28·6	—	—
Hertford	78·7	31·3	83·8	30·7	69·9	32·3	—	—
Wiltshire	78·0	28·7	94·2	31·1	65·2	26·9	—	—
Dorset	77·7	34·3	88·3	38·5	65·1	29·5	—	—
Berkshire	76·7	30·4	79·6	29·4	75·5	30·9	98·6	43·2
Hereford	75·8	43·0	85·8	51·9	70·2	38·1	—	—
Montgomery ...	75·8	23·8	78·2	20·0	74·5	25·9	—	—
Oxford	73·0	26·3	77·8	33·5	70·7	22·7	94·5	38·2

The corresponding rates for London and for England and Wales were as follows :—

—	0-1.	1-5.
London...	114·6	64·7
England and Wales	120·4	61·8

Table II.

1908.—*Infant Mortality per 1,000 Births in Administrative Counties.*

—	Under one week.	Under one month.	Under three months.	3-6 months.	6-12 months.	Number of Births in 1908.	Percentage of total Births occurring in Urban Districts.
Glamorgan	24·8	46·1	76·7	34·5	43·1	26,089	74·0
Durham	33·8	52·1	77·9	30·9	42·2	31,291	54·9
Northumberland ...	32·7	52·9	79·0	28·4	39·9	12,585	71·8
Monmouth	23·2	39·7	70·7	28·4	41·2	9,404	87·9
Carmarthen... ...	28·7	47·4	77·4	21·9	40·8	3,968	38·9
Stafford	28·2	46·8	72·9	27·5	31·3	27,149	81·2
Yorks, West Riding	27·3	43·8	67·9	26·4	37·3	40,733	75·5
Lancashire	25·8	42·5	68·4	26·6	35·6	44,132	87·7
Brecknockshire ...	25·7	43·8	67·3	24·9	36·3	1,323	35·1
Denbigh	29·3	46·4	72·7	27·4	26·6	3,686	27·9
Cumberland ...	29·3	45·4	68·9	25·3	32·4	7,158	67·1
Carnarvon	26·3	40·6	76·6	22·8	21·7	2,585	49·2
Derby	26·0	40·6	64·3	23·1	33·0	16,974	50·7
Nottingham... ...	25·6	43·0	66·1	23·9	29·8	9,847	66·1
Yorks, North Riding	28·0	44·0	64·8	21·6	28·7	8,042	62·0
Cheshire	23·0	38·0	60·1	24·4	29·2	15,882	74·1

TABLE II—*continued.*

—	Under one week.	Under one month.	Under three months	3–6 months.	6–12 months.	Number of Births in 1908.	Percentage of total Births occurring in Urban Districts.
Leicester	28·3	44·0	65·6	22·3	25·2	6,225	42·0
Flint...	28·1	45·1	64·2	15·5	28·1	1,995	43·3
Cardigan	17·1	35·1	54·1	30·4	22·8	1,053	29·4
Lincoln	25·8	39·8	59·4	20·2	26·7	10,580	43·3
Yorks, East Riding	26·9	41·8	61·5	17·7	26·9	3,562	37·4
Merioneth	25·2	40·9	58·8	30 4	15·7	953	42·9
Pembroke	27·4	41·9	62·5	18·6	23·3	1,934	41·9
Westmorland ...	31·0	45·7	62·0	14·7	26·9	1,226	43·0
Cornwall	27·7	41·1	62·0	19·9	21·2	7,353	42·9
Norfolk	30·3	42·9	62·7	15·0	25·3	7,225	19·0
Cambridge	28·4	43·2	62·0	14·8	25·8	4,192	41·4
Warwick	20·8	34·3	56·9	22·0	22·9	9,801	61·4
Shropshire	26·5	39·8	59·0	18·3	22·8	5,884	46·0
Anglesey	19·0	36·2	63·3	21·7	14·5	1,106	36·8
Worcester	24·6	38·6	57·3	21·0	20·8	10,231	56·9
Radnor	50·8	62·1	73·4	5·6	17·0	531	21·8
Middlesex	20·4	33·1	51·1	19·4	24·7	27,682	95·7
Northampton ...	27·7	42·1	58·7	15·0	20·6	5,345	54·0
Rutland	14·4	26·4	52·9	12·0	28·8	416	—
Bedford	24·2	37·9	59·2	15·3	16·7	4,428	60·9
Suffolk	26·1	39·6	55·8	14·1	21·0	7,422	39·6
Essex	22·9	37·6	53·4	15·3	20·6	24,844	76·5
Devon	21·7	33·9	49·9	16·6	21·7	9,140	49·4
Kent...	18·4	31·9	50·3	15·9	21·5	23,129	69·0
Huntingdon ...	25·0	36·2	51·1	16·2	17·5	1,603	35·9
Hampshire	22·4	36·1	51·8	14·7	17·1	11,289	51·4
Somerset	24·5	36·5	49·1	12·9	19·2	8,539	60·1
Gloucester	23·0	34·5	51·8	10·6	17·9	6,775	30·5
Sussex	24·6	35·7	49·0	12·5	18·3	9,246	50·8
Surrey	18·8	31·6	46·7	14·6	17·7	14,361	66·3
Buckingham ...	25·1	37·0	50·6	11·7	16·6	4,868	37·0
Hertford	20·3	33·2	47·7	12·9	18·1	6,802	62·8
Wiltshire	23·6	36·7	50·2	13·0	14·8	6,832	44·1
Dorset	21·6	35·0	48·5	9·9	19·3	4,453	54·5
Berkshire	18·6	32·1	46·2	12·1	18·4	4,304	29·2
Hereford	18·2	31·2	43·4	16·6	15·8	2,468	35·9
Montgomery ...	21·2	39·1	55·4	8·2	12·2	1,227	35·5
Oxford	20·9	30·6	44·6	13·1	15·3	3,204	33·3
England and Wales	24·3	40·3	64·4	23·6	32·4	942,611	—
London	21·7	36·2	58·2	23·3	33·1	121,808	—

For death-rates in each county at ages 0–1 and 1–5, *see* Table I.

Table III.

1908.—*Infant Mortality per 1,000 Births in the aggregate Urban Districts of Administrative Counties.*

—	Under one week.	Under one month.	Under three months.	3–6 months.	6–12 months.	Number of Births in 1908.
Glamorgan	25·5	47·6	80·0	37·1	47·7	19,296
Durham	31·9	49·9	74·5	29·6	43·1	17,172
Northumberland... ...	31·6	52·2	80·1	30·3	44·9	9,043
Monmouth	23·5	40·8	74·9	29·8	42·3	8,265
Carmarthen	31·1	46·6	75·1	16·8	37·6	1,544
Staffordshire	29·1	47·5	75·5	30·1	34·2	21,999
Yorks, West Riding ...	27·9	44·4	68·7	27·1	38·4	30,700
Lancashire	25·8	42·7	69·9	27·9	37·5	38,669
Brecknockshire	30·2	41·0	60·5	19·4	23·8	463
Denbigh	31·1	47·7	73·0	31·1	23·3	1,028
Cumberland	27·9	45·6	71·0	29·4	34·6	4,799
Carnarvon	31·5	46·4	80·2	26·8	26·0	1,271
Derby	26·4	40·4	64·3	23·5	32·4	8,610
Nottingham	23·5	42·2	67·9	26·4	33·3	6,511
Yorks, North Riding ...	25·3	41·4	62·6	26·1	36·8	4,982
Cheshire	23·3	39·7	64·3	27·0	33·8	11,770
Leicester	31·8	48·2	75·4	29·8	30·6	2,614
Flint	30·1	44·0	64·9	17·4	38·2	863
Cardigan	26·3	39·5	52·6	26·3	32·9	304
Lincoln	27·7	43·9	66·2	25·3	29·3	4,577
Yorks, East Riding ...	29·3	45·0	69·0	22·5	32·3	1,333
Merioneth	24·5	44·0	56·3	34·2	17·1	409
Pembroke	34·6	50·6	66·7	22·2	34·6	810
Westmorland	30·4	43·6	58·8	17·1	34·2	527
Cornwall	29·9	41·7	66·1	22·4	21·8	3,164
Norfolk	28·5	43·8	62·0	16·8	26·3	1,370
Cambridge	23·0	42·1	63·4	23·6	27·1	1,736
Warwick	20·9	33·2	57·0	23·1	25·2	6,020
Shropshire	23·3	38·1	63·6	20·7	29·2	2,705
Anglesey	9·8	34·4	71·3	19·6	27·0	407
Worcester	25·4	37·1	56·4	21·5	23·2	5,819
Radnor	8·6	17·2	25·8	8·6	25·9	116
Middlesex...	20·2	33·0	50·7	19·0	24·6	26,489
Northampton	30·8	44·7	63·7	14·6	22·9	2,886
Rutland	No Urban Districts.					
Bedford	27·8	43·8	67·5	16·7	16·3	2,697
Suffolk	27·2	41·1	57·1	13·6	25·2	2,942
Essex	22·6	38·7	55·5	16·5	20·9	19,000
Devon	20·4	34·5	52·9	20·2	28·8	4,516
Kent	17·9	32·3	50·7	16·7	22·0	15,967
Huntingdon	26·1	40·0	52·2	13·9	24·3	575
Hampshire	23·8	39·7	58·3	15·9	18·9	5,801
Somerset	24·0	37·6	52·0	16·5	28·5	3,329
Gloucester	24·2	35·8	53·3	16·9	27·6	2,065
Sussex	23·4	34·5	49·7	14·7	21·7	4,695
Surrey	20·1	32·3	48·3	16·4	18·0	9,516
Buckingham	21·1	32·2	44·4	17·8	21·1	1,802
Hertford	20·1	34·0	48·9	13·8	21·1	4,271
Wiltshire	22·6	39·8	57·4	16·9	19·9	3,015
Dorset	20·2	35·1	52·0	14·4	21·9	2,424
Berkshire	11·9	31·8	47·7	10·4	21·5	1,257
Hereford	14·7	30·5	39·5	22·6	23·7	886
Montgomery	20·7	36·8	50·6	11·5	16·1	435
Oxford	19·7	28·1	44·1	17·8	15·9	1,067

For death-rates in the aggregate urban districts of each county at 0–1 and at 1–5, *see* Table I.

Table IV.

1908.—*Infant Mortality per 1,000 Births in the aggregate Rural Districts of Administrative Counties.*

—	Under one week.	Under one month.	Under three months.	3–6 months.	6–12 months.	Number of Births in 1908.
Glamorgan	23·0	41·8	67·1	27·1	30·3	6,793
Durham	36·3	54·9	82·0	32·6	41·0	14,119
Northumberland	35·3	54·8	76·3	23·4	27·1	3,542
Monmouth	21·1	31·6	40·4	18·4	32·5	1,139
Carmarthen	27·2	47·9	78·8	25·2	42·9	2,424
Staffordshire	24·5	44·3	61·8	16·5	18·8	5,150
Yorks, W. Riding ...	25·6	41·9	65·6	24·2	33·8	10,033
Lancashire	26·0	41·4	57·5	17·4	22·1	5,463
Brecknockshire	23·3	45·4	71·0	27·9	43·0	860
Denbighshire	28·6	45·9	72 6	26·0	27·8	2,658
Cumberland	32·2	44·9	64·4	17·0	28·0	2,359
Carnarvon	21·3	35·0	73·1	19·0	17·5	1,314
Derbyshire	25·7	40·8	64·3	22·7	33·6	8,364
Nottinghamshire	29·7	44·4	62·6	18·9	23·2	3,336
Yorks, N. Riding ...	32·4	48·4	68·3	14·4	15·7	3,060
Cheshire	22·1	33·1	48·1	16·8	16·3	4,112
Leicestershire	25·8	41·0	58·4	16·9	21·3	3,611
Flintshire	26·5	45·9	63 6	14·2	20·3	1,132
Cardiganshire	13·4	33·4	54·7	32·1	18·7	749
Lincolnshire	24·3	36·6	54·3	16·3	24·7	6,003
Yorks, E. Riding	25·6	39·9	57·0	14·8	23·8	2,229
Merionethshire	25·7	38·6	60·6	27·6	14·7	544
Pembrokeshire	22·2	35·6	59·6	16·0	15·2	1,124
Westmorland	31·5	47·2	64·4	12·9	21·4	699
Cornwall	26·0	40·6	59·0	17·8	20·8	4,189
Norfolk	30·8	42·7	62·9	14·5	25·1	5,855
Cambridgeshire	32·2	44·0	61·1	8·6	24·8	2,456
Warwickshire	20·6	37·0	56·9	20·4	19·0	3,781
Shropshire	29·3	41·2	55·0	16·4	17·3	3,179
Anglesey	24·3	37·2	58·7	22·9	7·1	699
Worcestershire	23·6	40·6	58·5	20·4	17·7	4,412
Radnorshire	62·7	74·7	86·7	4·8	14·5	415
Middlesex	24·3	34·4	59·5	26·8	27·7	1,193
Northamptonshire ...	24·0	39·0	52·9	15·4	17·9	2,459
Rutland	14·4	26·4	52·9	12·0	28·8	416
Bedfordshire	18·5	28·9	46·2	13·3	17·3	1,731
Suffolk	25·4	38·6	54·9	14·5	18·3	4,480
Essex	23·6	34·1	46·6	11·3	19·3	5,844
Devonshire	22·9	33·3	46·9	13·2	14·7	4,624
Kent	19·4	30·9	49·3	14·2	20·4	7,162
Huntingdonshire	24·3	30·2	50·6	17·5	13·6	1,028
Hampshire	21·0	32·2	45·0	13·5	15·1	5,488
Somersetshire	24·8	35·9	47·2	10·6	13·2	5,210
Gloucestershire	22·5	34·0	51·2	7·8	13·6	4,710
Sussex	25·7	36·9	48·4	10·3	14·7	4,551
Surrey	16·3	30·3	43·6	11·1	17·1	4,845
Buckinghamshire	27·4	39·8	54·1	8·2	14·0	3,066
Hertfordshire	20·5	32·0	45·4	11·5	13·0	2,531
Wiltshire	24·4	34·3	44·5	10·0	10·7	3,817
Dorsetshire	23·2	35·0	44·4	4·4	16·3	2,029
Berkshire	21·3	32·2	45·6	12·8	17·1	3,047
Herefordshire	20·2	31·6	45·5	13·3	11·4	1,582
Montgomeryshire ...	21·5	40·4	58·1	6·3	10·1	792
Oxfordshire	21·5	31·8	44·9	10·8	15·0	2,137

For death-rates in the aggregate rural districts of each county at 0–1 and at 1–5, *see* Table I.

Table V.

1908.—*Infant Mortality per 1,000 Births in the aggregate of the County Boroughs of each Registration County.*

—	Under one week.	Under one month.	Under three months.	3–6 months.	6–12 months.	Number of Births in 1908.
Glamorgan	25·3	42·3	69·3	30·1	35·3	8,471
Durham	26·0	44·2	69·4	26·4	42·1	14,782
Northumberland... ...	33·2	52·0	77·0	25·3	37·1	8,382
Monmouth	26·4	45·5	78·7	20·0	36·7	2,504
Carmarthen			No County Boroughs.			
Staffordshire	26·9	44·7	77·2	30·5	32·3	13,393
Yorks, West Riding ...	26·7	45·1	70·1	25·8	40·9	38,832
Lancashire	24·7	42·8	72 2	30·2	45·4	86,566
Brecknockshire			No County Boroughs.			
Denbigh			No County Boroughs.			
Cumberland			No County Boroughs.			
Carnarvon			No County Boroughs.			
Derby	19 6	36·4	62·3	22·0	23·8	3,321
Nottingham	28·6	48·2	82·9	26·7	36·2	7,037
Yorks, North Riding ...	24·1	41·8	73·4	36·7	48·2	3,733
Cheshire	21·4	38·6	69·7	34·2	43·6	7,616
Leicester	23·6	37·3	65·3	25·9	38·6	5,680
Flint			No County Boroughs.			
Cardigan			No County Boroughs.			
Lincoln	20·0	32·9	59·2	28·2	33·2	3,650
Yorks, East Riding ...	26·6	41·0	68·7	30·8	39·7	10,359
Merioneth			No County Boroughs.			
Pembroke...			No County Boroughs.			
Westmorland			No County Boroughs.			
Cornwall			No County Boroughs.			
Norfolk	26·7	41·1	70·4	21·2	28·2	4,574
Cambridge			No County Boroughs.			
Warwick*	26·5	42·7	71·1	28·1	38·3	18,771
Shropshire			No County Boroughs.			
Anglesey			No County Boroughs.			
Worcester	28·0	44·5	71·0	24·4	34·0	2,790
Radnor			No County Boroughs.			
Middlesex...			No County Boroughs.			
Northampton	19·1	36·2	56·8	16·6	23·5	2,043
Rutland			No County Boroughs.			
Bedford			No County Boroughs.			
Suffolk	17·7	33·7	65·3	15·5	29·9	1,808
Essex	22·7	38·4	61·0	30·5	37·1	9,214
Devon	26·1	41·6	68·0	27·3	29·1	5,908
Kent	15·2	38·9	62·5	15·2	37·2	592
Huntingdon			No County Boroughs.			
Hampshire	24·5	39·2	60·9	19·1	22·8	10,201
Somerset	20·1	35·1	42·2	9·0	28·1	996
Gloucester	24·3	42·2	69·0	23·8	31·5	10,025
Sussex	25·3	38·0	58·7	15·8	23·5	3,867
Surrey	16·9	32·1	53·5	18·2	27·4	4,017
Buckingham			No County Boroughs.			
Hertford			No County Boroughs.			
Wiltshire			No County Boroughs.			
Dorset			No County Boroughs.			
Berkshire	10·8	27·6	53·1	17·9	27·6	1,847
Hereford			No County Boroughs.			
Montgomery			No County Boroughs.			
Oxford	16·0	31·2	52·3	19·4	22·8	1,186

For death-rates in the aggregate county boroughs in each registration county at 0–1 and at 1–5, *see* Table I.

* Including Birmingham.

Table VI.

1908.—*Infant Mortality per 1,000 Births from various Diseases in Administrative Counties.*

—	Measles.	Whooping Cough.	Diarrhœal Diseases.	Premature Birth.	Congenital Defects.	Injury at Birth.	Want of Breast Milk &c.	Atrophy, Debility, Marasmus.	Tuberculous Diseases.	Convulsions.	Bronchitis and Pneumonia.	Other Causes.
Glamorgan	3·6	6·7	27·1	15·5	5·9	·4	·3	24·7	4·1	22·0	24·7	19·3
Durham	1·8	6·6	26·9	23·6	6·4	1·3	·2	27·1	5·8	13·0	25·3	13·0
Northumberland ...	·8	5·7	26·7	23·7	5·4	·7	·2	26·2	5·7	13·3	21·6	17·3
Monmouth	2·4	8·8	22·1	16·7	3·9	·3	·3	20·3	4·5	15·8	28·7	16·5
Carmarthen	4·8	4·0	12·6	12·9	3·5	—	·8	26·2	5·5	29·2	21·2	19·4
Staffordshire	1·4	3·9	19·0	19·7	7 5	·8	·4	24·1	5·7	12·5	19·8	16·9
Yorks, West Riding ...	2·8	5·2	21·3	20·8	7 0	·7	1·0	16·5	4·4	13·1	23·4	15·4
Lancashire	1·8	5·0	22·7	20·9	6·3	7	·6	16·5	6·2	9·0	21·8	19·1
Brecknock	1·5	6·8	10·6	9·8	3·0	·8	—	31·0	6·0	15·9	25·7	17·4
Denbigh	—	13·3	10 9	17·9	5·7	·3	1·1	21·1	6·2	15·5	20 3	14·4
Cumberland	·1	8·4	9·4	17·7	5·3	1·4	·7	20·7	7·4	10·2	23·5	21·8
Carnarvon	·4	5·0	6·6	17 8	7 7	·8	2·3	11·2	3·9	28·3	17·0	20·1
Derby	1·2	3·2	16·4	20·5	5·9	·6	·3	17·6	5·7	11·2	24·0	13·8
Nottingham	·9	4·5	15·1	20·3	5·5	·1	·7	18·4	5·2	13·4	20·7	15·0
Yorks, North Riding..	1·9	4·1	16·6	22·1	5·6	·5	1·5	18·4	3·9	10·2	15·5	14 8
Cheshire	2·7	5·2	15·0	19·3	4·9	·8	·6	16·7	5·6	11·3	18·6	13·0
Leicester	1·0	5·6	10·8	24·6	4·8	·9	1·4	21·7	3·2	10·0	15·9	13·2
Flint	2·0	6·5	12·5	19·1	2·0	—	·5	15·6	4·5	12·5	19·1	13·5
Cardigan	—	3·8	14·3	10·4	5·7	·9	·9	12·4	1·9	22·8	15·2	19·0
Lincoln	·3	7·1	9·5	21·8	6·0	·7	·9	16·8	3·4	12·9	14·8	12·1
Yorks, East Riding ...	·3	5·1	9·8	21·3	9·0	—	1·1	12·6	2·0	15·7	16·6	12·6
Merioneth	—	4·2	8·4	22·0	1·1	—	—	7·3	3·2	22·0	18·9	17·8
Pembroke	1·0	3·1	9·8	15·5	1·6	1·0	1·6	17·1	3·6	15·5	16·0	18·6
Westmorland... ...	2·5	9 8	5·7	27·7	4·9	·8	3·3	9·8	1·6	10·6	19·6	7·3
Cornwall	·1	6·8	8·4	21·4	2·2	·7	·1	14·0	2·6	10·5	16·5	19·8
Norfolk	3·4	10·1	3·5	23·0	4·6	·7	1·0	17·6	2·3	8·0	15·4	13·4
Cambridge	1·4	9·3	5·7	18·8	5·5	1·7	—	19·8	4·1	5·0	16·0	15·3
Warwick	·7	4·2	15·7	18·4	3·2	·4	·7	13·5	3·6	8·7	15·4	17·3
Shropshire	1·9	3·9	8·0	19·7	4·9	1·2	·5	15·6	2·9	10·0	22·1	9·4
Anglesey	—	10·9	1·8	5·4	2·7	1·8	--	22·6	2·7	21·7	16·3	13·6
Worcester	·3	3·1	12·0	19·5	4·5	·8	·9	17·8	4·0	5·6	14·2	16·4
Radnor	—	—	1·9	35·8	9·4	3·8	—	15·0	1·9	17·0	5·6	5·6
Middlesex	1·6	2·7	15·5	17·4	5·4	1·2	1·0	11·8	4·0	4·6	15·9	14·1
Northampton... ...	·9	8·2	6·6	24·1	3·9	1·1	1·7	11·8	1·9	6·4	15·2	12·5
Rutland	—	4·8	4·8	9·6	4·8	—	—	9·6	7·2	12·6	21·6	19·3
Bedford	·2	3·8	6·3	24·4	4·5	—	—	13·1	1·4	9·0	14·0	14·5
Suffolk	·9	5·5	3·5	22·2	4·6	·3	·3	16·2	3·8	8·1	13·3	12·2
Essex	1·2	2·4	11·8	17·9	5·4	·5	·9	13·8	3·7	6·2	13·7	11·8
Devon...	1·4	4·2	9·0	16·2	4·8	·4	·4	10·5	2·1	9·5	14·4	15·3
Kent	1·0	3·1	12·9	15·6	3·9	·5	·6	12·2	3·4	5·9	14·6	14·0
Huntingdon	—	5·0	6·2	18·7	3·7	—	·6	11·2	3·1	4·4	19·4	12·5
Hampshire	·5	5·2	10·2	18·9	4·2	·8	1·1	11·8	2·6	4·9	13·3	10·1
Somerset	·6	2·3	7·9	15·7	5·4	·8	·8	10 6	2·7	7·0	14·9	12·5
Gloucester	·6	4·4	7·7	17·1	2·8	1·3	·4	11·7	2·8	6·8	14·2	10·5
Sussex...	·2	3·1	7·7	19·8	3·6	1·0	·4	12·8	2·5	4·3	13·3	11·1
Surrey...	1·5	3·1	9·7	17·3	5·0	1·2	·6	8·6	3·1	6·2	12·9	9·8
Buckingham	·4	4·1	5·8	21·6	3·3	1·4	—	7·2	1·2	7·2	12·1	14·6
Hertford	·3	3·8	7·1	17·5	4·3	·6	·3	9·5	3·7	7·8	13·4	10·4
Wiltshire	·6	3·8	5·0	16·7	1·9	·1	—	8·6	1·2	5·9	14·6	19·6
Dorset...	·7	6·3	4·5	16·6	5·4	·2	·2	10·1	2·5	8·1	12·6	10·5
Berkshire	·2	2·1	5·6	15·8	6·5	·2	·7	11·4	1·4	7·7	13·0	12·1
Hereford	—	2·0	5·7	15·8	1·6	·4	1·2	15·4	2·9	6·9	14·2	9·7
Montgomery	·8	4·9	2·4	15·5	4·9	—	8	6·5	1·6	16·3	9·0	13·1
Oxford	—	3·7	8·1	17·5	4·4	·6	—	8·1	1·6	7·5	10·9	10·6
England and Wales ...	1·9	5·0	19·9	19·9	6·7	1·0	·8	15·0	4·7	10·8	20·4	14·3
London	2·7	3·9	21·1	18·0	5·6	·9	·6	14·6	5·6	4·3	19·1	18·2

Table VII.

1908.—*Infant Mortality per 1,000 Births, from various Diseases, in the aggregate Urban Districts of Counties.*

	Measles.	Whooping Cough.	Diarrhœal Diseases.	Premature Birth.	Congenital Defects.	Injury at Birth.	Want of Breast Milk, &c.	Atrophy, Debility, Marasmus.	Tuberculous Diseases.	Convulsions.	Bronchitis and Pneumonia.	Other causes.
Glamorgan	3·9	6·9	31·2	15·9	6·2	·5	·3	27·9	4·1	21·4	27·8	18·7
Durham	2·2	7·2	24·3	21·8	6·6	1·0	·2	26·2	6·1	12·2	26·1	13·3
Northumberland ...	·7	5·9	29·4	23·9	4·6	·9	·2	29·1	6·2	13·8	21·3	19·3
Monmouth	2·6	9·7	23·1	17·2	4·0	·2	—	22·5	4·1	16·0	30·4	17·2
Carmarthen	6·5	·6	14·3	11·0	1·9	—	·7	16·8	3·2	31·1	26·6	16·8
Staffordshire	1·4	3·8	21·9	19·8	7·6	·6	·5	25·6	6·4	13·2	21·0	18·0
Yorks, West Riding...	3·2	5·4	21·5	20·7	7·5	·7	1·1	17·2	4·2	13·3	23·4	16·0
Lancashire	1·9	5·2	24·4	21·0	6·5	·7	·6	17·0	6·8	8·9	22·4	19·9
Brecknockshire ...	4·3	2·2	—	15·1	—	—	—	28·1	2·2	10·8	25·9	15·1
Denbigh	—	8·8	10·7	23·3	2·9	1·0	1·0	17·5	6·8	21·4	16·5	17·5
Cumberland	·2	8·3	10·6	15·6	5·6	1·7	1·1	21·5	9·0	10·6	25·8	25·0
Carnarvon	—	6·3	7·9	17·3	7·1	·8	3·9	12·6	3·1	26·8	21·2	26·0
Derby	1·5	3·3	18·5	21·5	6·4	·7	·2	16·7	5·2	10·6	21·8	13·8
Nottingham	·8	4·6	18·3	20·6	5·1	—	·8	20·1	5·8	13·8	22·7	15·0
Yorks, North Riding...	2·6	4·0	22·1	18·5	4·0	·6	2·2	19·9	4·2	10·2	18·9	18·3
Cheshire	3·5	5·6	18·7	19·5	4·5	·7	·8	18·7	6·2	12·7	20·1	14·1
Leicester	1·9	6·5	18·7	27·5	5·4	·8	1·1	31·4	3·1	12·6	14·9	11·9
Flint	3·5	10·4	18·5	16·2	1·2	—	—	17·4	2·3	15·1	22·0	13·9
Cardigan	—	—	19·7	16·4	9·9	3·3	3·3	9·9	—	16·4	13·2	19·7
Lincoln	·4	6·5	12·7	22·5	5·2	·9	·9	24·4	3·9	12·0	19·0	12·4
Yorks, East Riding ...	—	4·5	18·0	19·5	9·0	—	—	16·5	3·8	19·5	16·5	16·5
Merioneth	—	4·9	4·9	17·1	—	—	—	2·4	4·9	24·5	14·7	34·2
Pembroke	2·5	6·2	17·3	14·8	1·2	2·5	1·2	23·4	6·2	9·9	13·6	24·7
Westmorland... ...	3·8	17·1	3·8	26·5	—	1·9	5·7	7·6	1·9	11·4	20·9	9·5
Cornwall	—	8·2	11·4	21·2	2·9	·3	·3	14·2	2·5	10·1	18·3	20·9
Norfolk	5·1	8·0	5·9	27·0	2·9	·7	·7	19·0	1·5	5·1	13·9	15·3
Cambridge	2·9	13·2	9·8	21·9	2·3	·6	—	19·6	5·2	6·3	17·9	14·4
Warwick	1·0	4·8	17·9	17·6	3·2	·3	·3	13·8	4·5	7·3	15·6	19·0
Shropshire	2·6	5·2	8·5	18·5	3·7	·7	1·1	17·8	2·6	10·0	29·9	12·9
Anglesey	—	19·6	4·9	2·5	—	—	—	32·0	4·9	17·2	17·2	19·6
Worcester	·3	2·8	16·3	17·6	4·7	·7	·3	18·2	4·1	4·6	14·8	16·7
Radnor	—	—	8·6	17·2	—	—	—	—	—	—	8·6	25·9
Middlesex	1·6	2·8	15·4	17·3	5·3	1·2	·7	11·7	3·9	4·5	15·8	14·1
Northampton... ...	1·7	9·7	6·6	27·7	4·2	·3	2·8	11·8	2·1	6·6	14·2	13·5
Rutland	No Urban Districts.											
Bedford	—	·8	7·8	30·8	4·8	—	—	13·7	1·5	10·0	12·2	18·9
Suffolk	·7	4·4	3·4	26·5	6·1	—	—	11·2	7·2	10·9	13·6	11·9
Essex	1·3	1·9	13·4	17·6	5·8	·5	·8	15·2	3·9	6·3	13·7	12·5
Devon	2·0	5·1	12·4	15·5	5·8	·2	·4	12·4	2·7	10·4	17·3	17·7
Kent	·9	3·3	13·5	16·3	3·5	·4	·8	11·5	3·7	5·8	14·7	15·0
Huntingdon	—	8·7	13·9	17·4	—	—	1·7	15·7	—	—	19·1	13·9
Hampshire	·7	4·8	15·0	22·4	4·0	·7	·5	12·3	3·4	6·0	14·1	9·2
Somerset	1·2	1·5	12·6	15·9	5·1	·9	1·2	13·2	4·5	8·4	20·2	12·3
Gloucester	·5	4·8	11·6	19·9	1·9	1·5	1·0	14·5	6·3	6·8	14·5	14·5
Sussex...	·2	3·4	11·3	20·5	4·0	1·1	.6	12·4	2·8	3·8	14·5	11·5
Surrey	1·5	3·8	10·7	18·8	4·1	·9	·4	9·3	3·0	6·0	13·5	10·7
Buckingham	—	6·1	8·9	21·7	3·3	·6	—	9·4	1·7	7·8	10·0	13·8
Hertford	·5	3·3	7·3	18·5	3·5	·5	·2	10·3	4·9	9·1	15·2	10·5
Wiltshire	·3	4·0	6·6	16·3	2·0	—	—	7·0	2·3	2·3	22·6	30·8
Dorset...	1·2	7·9	7·0	16·1	6·2	·4	·4	11·2	4·1	7·4	14·4	12·0
Berkshire	—	·8	9·6	12·7	4·0	—	·8	15·1	1·6	10·3	15·9	8·8
Hereford	—	1·1	7·9	15·8	1·1	—	2·3	22·6	3·4	6·8	11·3	13·5
Montgomery	2·3	2·3	2·3	13·8	9·2	—	—	6·9	2·3	13·8	16·1	9·2
Oxford	—	1·9	11·2	15·0	1·9	·9	—	4·7	1·9	8·4	19·7	12·2

Table VIII.

1908.—*Infant Mortality per 1,000 Births, from various Diseases, in the aggregate Rural Districts of Counties.*

	Measles.	Whooping Cough.	Diarrhœal Diseases.	Premature Birth.	Congenital Defects.	Injury at Birth.	Want of Breast Milk, &c.	Atrophy, Debility, and Marasmus.	Tuberculous Diseases.	Convulsions.	Bronchitis and Pneumonia.	Other Causes.
Glamorgan	2·6	6·2	15·5	14·4	5·0	·4	—	15·5	4·4	23·7	15·9	20·9
Durham	1·3	5·8	30·1	25·7	6·2	1·6	·2	28·2	5·5	13·8	24·4	12·8
Northumber'and ...	1·1	5·1	19 8	23·2	7·3	·3	·3	18·9	4·2	11·9	22·3	12·4
Monmouth	—	2·6	14·9	13·2	3·5	·9	2·6	4·4	7·0	14·1	16·7	11·4
Carmarthen	3·7	6·2	11·6	14·0	4·5	—	·8	32·2	7·0	28·1	17·7	21·1
Staffordshire ...	1 6	4·3	7·0	19·2	6·8	1·6	·2	17·5	2·9	9·7	14·3	12·0
Yorks, West Riding...	1·6	4·8	20·7	20·6	5·3	·7	·6	14·4	5·2	12·6	23·4	13·7
Lancashire	1·1	3·5	10·8	19·9	4·2	·4	·4	13·4	2·9	9·5	17·4	13·5
Brecknockshire ...	—	9·3	16·3	7·0	4·7	1·2	—	32·5	8·1	18·6	25·6	18·6
Denbighshire... ...	—	15·0	10·9	15·8	6·8	—	1·1	22·6	6·0	13·2	21·8	13·2
Cumberland	—	8·5	6·3	22 0	4·7	·8	—	19·1	4·2	9·3	18·7	15·3
Carnarvon	·8	3·8	5·3	18·2	8·4	·8	·8	9·9	4·6	29·7	12 9	14·4
Derbyshire	·8	3·1	14·2	19·6	5·5	·5	·4	18·5	6·2	11·8	26·2	13·8
Nottinghamshire ...	1·2	4·2	9·0	19·8	6·3	·3	·6	15·0	3·9	12·6	16·8	15·0
Yorks, North Riding...	·7	4·3	7·8	28·1	8·2	·3	·3	16·0	3·3	10·1	10·1	9·2
Cheshire	·5	3·9	4·6	18 5	6·1	1·2	--	10·9	3·9	7·5	14·1	10·0
Leicestershire ...	·3	5·0	5·0	22·4	4·4	1·1	1·7	14·7	3·3	8·0	16·6	14·1
Flintshire	·9	3·5	8·0	21·2	2·7	—	·9	14·1	6·2	10·6	16·8	13·2
Cardiganshire... ...	—	5·3	12·0	8·0	4·0	—	—	13·4	2·7	25·4	16·0	18·7
Lincolnshire	·2	7·5	7·0	21·3	6·7	·5	·8	11·0	3·0	13·6	11·7	12·0
Yorks, East Riding ...	·4	5·4	4·9	22·5	9·0	—	1·8	10·3	·9	13·5	16·6	10·3
Merionethshire ...	—	3·7	11·0	25·8	1·8	—	—	11·0	1·8	20·2	22·1	5·5
Pembrokeshire ...	—	·9	4·4	16·0	1·8	—	1·8	12·5	1·8	19·6	17·8	14·2
Westmorland... ...	1·4	4·3	7·2	28·6	8·6	—	1·4	11·5	1·4	10·0	18·6	5·7
Cornwall	·2	5·7	6·2	21·5	1·7	1·0	—	13·9	2·6	10·7	15·0	19·1
Norfolk	3·1	10·6	2·9	22·0	5·0	·7	1·0	17·2	2·6	8·7	15·7	13·0
Cambridgeshire ...	·4	6·5	2·9	16·7	7·7	2·4	—	19·9	3·3	4·1	14·7	15·9
Warwickshire... ...	·3	3·2	12·2	19·8	3·2	·5	1·3	13·0	2·1	10·8	15·1	14·8
Shropshire	1·3	2·8	7·5	20·8	6·0	1·6	—	13·8	3·1	10·1	15·4	6·3
Anglesey	—	5·7	—	7·2	4·3	2·9	—	17·2	1·4	24·3	15·7	10·0
Worcestershire ...	·2	3·6	6·4	22·2	4·3	·9	1·6	17·2	3·9	6·8	13·4	16·1
Radnorshire	—	—	—	41·0	12·0	4·8	—	19·3	2·4	21·7	4·8	—
Middlesex	·8	2·5	17·6	18·4	7·6	—	7·6	14·2	6·7	5·9	17·6	15·1
Northamptonshire ...	—	6·5	6·5	19·9	3·7	2·0	·4	11·8	1·6	6·1	16·3	11·4
Rutland	—	4·8	4·8	9·6	4·8	—	—	9·6	7·2	12·0	21·6	19 3
Bedfordshire	·6	8·7	4·0	14·4	4·0	—	—	12·1	1·2	7·5	16·8	7·5
Suffolk	1·1	6·3	3·6	19·4	3·6	·4	·4	19·4	1·6	6·2	13·2	12·5
Essex...	·9	3·6	6·8	18·8	3·9	·7	1·2	9·1	2·9	6·2	13·5	9·6
Devonshire	·9	3·2	5·6	16·9	3 9	·6	·4	8·6	1·5	8·7	11·5	13·0
Kent	1·3	2·5	11·4	14·1	4·7	·7	—	13·7	2·7	6·4	14·5	11·9
Huntingdonshire ...	—	2·9	1·9	19·5	5·7	—	—	8·8	4·9	6·8	19·5	11·7
Hampshire	·4	5·7	5·1	15·3	4·4	·9	1·6	11·3	1·8	3·6	12·4	11·1
Somersetshire ...	·2	2·9	4·8	15·5	5·6	·8	·6	8·8	1·5	6·1	11·5	12·7
Gloucestershire ...	·6	4·2	5·9	15·9	3·2	1·3	·2	10·4	1·3	6·9	14·0	8·7
Sussex...	·2	2·9	3·9	19·1	3·1	·9	·2	13·2	2·2	4·8	12·1	10·8
Surrey...	1·4	1·9	7·6	14·4	6·8	1·7	1·0	7·2	3·3	6·6	11·8	8·1
Buckinghamshire ...	·6	2·9	3·9	21·5	3·3	2·0	—	5·9	1·0	6·8	13·4	15·0
Hertfordshire ...	—	4·7	6·7	15·8	5·5	·8	·4	8·3	1·6	5·5	10·3	10·3
Wiltshire	·8	3·7	3·7	17·0	1·8	·3	—	9·9	·3	8·6	8·4	10·7
Dorsetshire	—	4·4	1·5	17·2	4·4	—	—	8·9	·5	8·9	10·4	8·9
Berkshire	·3	2·6	3·9	17·1	7·6	·3	·7	9·8	1·3	6·6	11·8	13·5
Herefordshire ...	—	2·5	4·4	15·8	1·9	·6	·7	11·4	2·5	7·0	15·8	7·6
Montgomeryshire ...	—	6·3	2·5	16·4	2·5	—	1·3	6·3	1·3	17·7	5·1	15·1
Oxfordshire	—	4·7	6·6	18·7	5·6	·5	—	9·8	1·4	7·0	6·6	9·8

Table IX.

1908.—Infant Mortality per 1,000 Births, from certain Diseases, in aggregate County Boroughs in Counties.

	Measles.	Whooping Cough.	Diarrhœal Diseases.	Premature Births.	Congenital Defects.	Injury at Birth.	Want of Breast Milk, &c.	Atrophy, Debility, and Marasmus.	Tuberculous Diseases.	Convulsions.	Bronchitis and Pneumonia.	Other Causes.
Glamorgan	1·9	4·6	25·4	19·2	2·1	—	2·0	21·2	5·8	18·2	16·8	17·5
Durham	1·2	8·2	18·5	19·3	13·0	1·8	·3	19·5	4·2	11·0	25·9	14·9
Northumberland ...	·6	5·7	17·9	24·8	17·4	1·8	1·2	12·2	4·7	11·3	26·8	15·0
Monmouth	—	10·8	14·8	25·5	11·2	·4	·4	14·4	2·8	17·6	17·6	19·9
Carmarthen	No County Boroughs.											
Staffordshire	·4	5·3	25·8	21·1	5·2	1·0	·5	17·5	8·7	10·1	25·4	19·0
Yorks, West Riding...	2·3	5·7	23·6	20·9	9·8	1·1	2·2	16·0	5·4	9·1	23·7	17·0
Lancashire	3·1	5·2	27·2	20·7	5·2	·6	·3	21·6	5·4	9·3	25·5	23·7
Brecknockshire ...	No County Boroughs.											
Denbigh	No County Boroughs.											
Cumberland	No County Boroughs.											
Carnarvon	No County Boroughs.											
Derby...	·6	2·1	15·1	22·0	8·1	·6	·6	13·2	6·3	13·3	14·5	11·7
Nottingham	1·3	4·0	27·0	26·4	6·7	1·0	·6	12·4	4·0	7·5	25·4	29·5
Yorks, North Riding...	3·2	·3	41·0	17·7	3·5	—	·8	29·4	4·5	9·4	23·3	25·2
Cheshire	3·3	5·9	29·3	21·4	3·9	·4	1·6	23·0	8·0	7·5	25·7	17·5
Leicester	6·0	3·2	26·1	19·9	2·3	—	—	19·9	5·3	15·1	15·5	16·5
Flint	No County Boroughs.											
Cardigan	No County Boroughs.											
Lincoln	1·4	1·9	25·2	17·5	2·2	·6	—	21·7	5·5	12·9	17·5	14·2
Yorks, East Riding ...	2·4	2·6	37·3	18·4	6·3	·4	·2	22·7	4·0	10·8	19·4	14·7
Merioneth	No County Boroughs.											
Pembroke	No County Boroughs.											
Westmorland... ...	No County Boroughs.											
Cornwall	No County Boroughs.											
Norfolk	—	3·9	15·1	24·7	6·8	·7	2·0	18·8	10·7	10·5	15·7	10·9
Cambridge	No County Boroughs.											
Warwick	·7	7·1	28·1	21·5	16·8	·5	1·3	14·5	3·4	6·2	20·1	17·3
Shropshire	No County Boroughs.											
Anglesey	No County Boroughs.											
Worcester	·7	3·9	15·8	18·3	5·7	2·2	·4	27·2	4·7	7·2	22·9	20·4
Radnor	No County Boroughs.											
Middlesex	No County Boroughs.											
Northampton... ...	—	5·4	7·3	18·1	9·3	—	·5	14·7	1·0	4·4	23·5	12·7
Rutland	No County Boroughs.											
Bedford	No County Boroughs.											
Suffolk	2·2	3·3	16·1	17·7	3·3	—	—	23·8	6·6	7·8	15·5	14·4
Essex	4·4	3·9	29·6	15·7	6·0	—	·2	26·6	3·7	5·2	17·3	16·0
Devon...	—	7·4	20·7	18·3	5·4	1·0	·7	15·4	4·2	9·1	24·1	18·1
Kent	—	6·8	8·4	18·6	5·1	—	—	5·1	11·8	10·1	27·0	22·0
Huntingdon	No County Boroughs.											
Hampshire	1·2	4·6	11·4	21·5	4·3	1·4	·3	13·5	3·7	5·8	17·8	17·3
Somerset	11·0	1·0	6·0	19·1	1·0	—	—	12·0	2·0	2·0	17·1	8·1
Gloucester	2·1	7·5	17·3	20·8	·9	·2	—	14·0	4·1	8·9	23·5	25·0
Sussex...	·2	3·6	9·6	18·1	5·7	·3	—	18·6	4·4	4·9	19·4	13·2
Surrey...	5·2	2·7	12·5	16·2	4·7	1·0	—	19·9	3·7	4·5	16·0	12·7
Buckingham	No County Boroughs.											
Hertford	No County Boroughs.											
Wiltshire	No County Boroughs.											
Dorset...	No County Boroughs.											
Berkshire	2·7	10·3	14·1	14·1	2·2	—	·5	14·1	1·1	2·7	23·8	13·0
Hereford	No County Boroughs.											
Montgomery	No County Boroughs.											
Oxford	—	6·7	13·5	18·6	2·5	—	3·4	12·7	2·5	1·7	24·5	8·4

Table X.

England and Wales.—Death-rates per 1,000 *births or per* 1,000 *survivors at the beginning of each year of life.*†*

Year.	Age.				
	0–1.	1–2.	2–3.	3–4.	4–5.
1855	154 (*127*)				
1856	146 (*120*)	58·5 (*168*)			
1857	156 (*128*)	64·4 (*185*)	33·6 (*242*)		
1858	158 (*130*)	67·2 (*193*)	40·5 (*292*)	29·5 (*339*)	
1859	157 (*129*)	66·2 (*190*)	36·9 (*266*)	26·5 (*304*)	20·2 (*314*)
1860	147 (*121*)	59·0 (*169*)	29·9 (*215*)	19·8 (*227*)	14·4 (*224*)
1861	154 (*127*)	68·3 (*196*)	32·9 (*237*)	20·2 (*232*)	14·2 (*221*)
1862	155 (*127*)	64·5 (*185*)	35·5 (*256*)	23·2 (*266*)	16·5 (*256*)
1863	150 (*123*)	79·7 (*228*)	41·8 (*301*)	29·8 (*342*)	22·5 (*349*)
1864	154 (*127*)	66·3 (*190*)	41·2 (*297*)	28·0 (*321*)	20·9 (*325*)
1865	161 (*132*)	65·6 (*188*)	33·1 (*238*)	24·6 (*282*)	16·5 (*256*)
1866	160 (*131*)	67·8 (*194*)	35·0 (*252*)	21·6 (*248*)	17·0 (*264*)
1867	154 (*127*)	59·7 (*171*)	28·6 (*206*)	18·1 (*208*)	12·8 (*199*)
1868	157 (*129*)	63·4 (*182*)	32·4 (*233*)	21·6 (*248*)	16·0 (*248*)
1869	154 (*127*)	61·7 (*177*)	33·4 (*241*)	23·0 (*264*)	17·2 (*267*)
1870	162 (*133*)	62·6 (*179*)	32·6 (*235*)	23·4 (*269*)	17·9 (*278*)
1871	158 (*130*)	62·0 (*178*)	30·3 (*218*)	20·4 (*234*)	16·1 (*250*)
1872	152 (*125*)	58·3 (*167*)	27·2 (*196*)	17·6 (*202*)	12·9 (*200*)
1873	150 (*123*)	55·1 (*158*)	25·4 (*183*)	16·6 (*191*)	11·5 (*179*)
1874	153 (*126*)	59·7 (*171*)	31·1 (*224*)	21·6 (*248*)	15·9 (*247*)
1875	158 (*130*)	60·1 (*172*)	27·9 (*201*)	19·0 (*218*)	14·4 (*224*)
1876	149 (*122*)	56·1 (*161*)	25·8 (*186*)	17·2 (*197*)	12·9 (*200*)
1877	136 (*112*)	54·9 (*157*)	24·9 (*179*)	16·3 (*187*)	12·0 (*186*)
1878	153 (*126*)	61·5 (*176*)	28·7 (*207*)	18·8 (*216*)	13·6 (*211*)
1879	135 (*111*)	55·4 (*159*)	25·6 (*184*)	17·3 (*199*)	13·0 (*202*)
1880	153 (*126*)	63·8 (*183*)	27·8 (*200*)	17·3 (*199*)	13·3 (*207*)
1881	130 (*107*)	46·9 (*134*)	21·8 (*157*)	15·3 (*176*)	11·5 (*179*)
1882	141 (*116*)	57·4 (*165*)	25·6 (*184*)	16·7 (*192*)	12·8 (*199*)
1883	137 (*113*)	52·4 (*150*)	22·9 (*165*)	15·8 (*181*)	11·9 (*185*)
1884	148 (*122*)	56·2 (*161*)	23·9 (*172*)	15·3 (*176*)	11·6 (*180*)
1885	137 (*113*)	52·5 (*151*)	23·0 (*166*)	14·3 (*164*)	10·4 (*161*)
1886	150 (*123*)	55·2 (*158*)	21·9 (*158*)	13·7 (*157*)	9·54 (*148*)
1887	143 (*118*)	53·7 (*154*)	22·7 (*164*)	15·0 (*172*)	10·8 (*168*)
1888	136 (*112*)	48·0 (*138*)	20·6 (*148*)	13·3 (*153*)	9·58 (*149*)
1889	144 (*118*)	54·9 (*157*)	21·6 (*156*)	14·0 (*161*)	10·0 (*155*)
1890	149 (*122*)	55·0 (*158*)	22·6 (*163*)	14·3 (*164*)	10·5 (*163*)
1891	152 (*125*)	56·4 (*162*)	22·2 (*160*)	13·7 (*157*)	9·83 (*153*)
1892	146 (*120*)	54·5 (*156*)	21·9 (*158*)	14·0 (*161*)	10·1 (*157*)
1893	160 (*131*)	50·5 (*145*)	21·5 (*155*)	14·5 (*166*)	10·7 (*166*)
1894	135 (*111*)	46·3 (*133*)	19·1 (*138*)	13·0 (*149*)	9·44 (*147*)
1895	163 (*134*)	53·2 (*153*)	20·3 (*146*)	12·5 (*144*)	9·11 (*141*)
1896	147 (*121*)	51·4 (*147*)	21·0 (*151*)	14·4 (*165*)	10·4 (*161*)
1897	156 (*128*)	48·3 (*138*)	19·5 (*141*)	11·8 (*135*)	8·70 (*135*)
1898	160 (*131*)	49·7 (*142*)	18·5 (*133*)	12·1 (*139*)	8·23 (*128*)
1899	163 (*134*)	46·6 (*134*)	18·7 (*135*)	11·9 (*137*)	8·93 (*139*)
1900	154 (*127*)	48·1 (*138*)	18·9 (*136*)	12·6 (*145*)	9·28 (*144*)
1901	151 (*124*)	43·3 (*124*)	17·1 (*123*)	11·5 (*132*)	8·68 (*135*)
1902	134 (*110*)	41·1 (*118*)	17·1 (*123*)	11·7 (*134*)	8·77 (*136*)
1903	132 (*109*)	39·1 (*112*)	15·4 (*111*)	9·72 (*112*)	7·19 (*112*)
1904	145 (*119*)	44·1 (*126*)	16·5 (*119*)	10·4 (*119*)	7·57 (*118*)
1905	127 (*104*)	37·7 (*108*)	15·1 (*109*)	9·81 (*113*)	7·17 (*111*)
1906	133 (*109*)	37·8 (*108*)	14·7 (*106*)	9·33 (*107*)	6·87 (*107*)
1907	117 (*96*)	37·2 (*107*)	15·2 (*110*)	10·0 (*115*)	7·32 (*114*)
1908	122 (*100*)	34·9 (*100*)	13·9 (*100*)	8·71 (*100*)	6·44 (*100*)

* The italic figures in parenthesis give relative death-rates for each year of life, the corresponding death-rate in the year, 1908, being stated as 100.

† As explained in the footnote on page 14, the infant death-rates in this table are calculated on the average annual births in two years. On this basis the infant death-rate in 1909 was 107, and the relative death-rate was 88. (Calculated in the usual way, the infant death-rate in 1909 was 109.)

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